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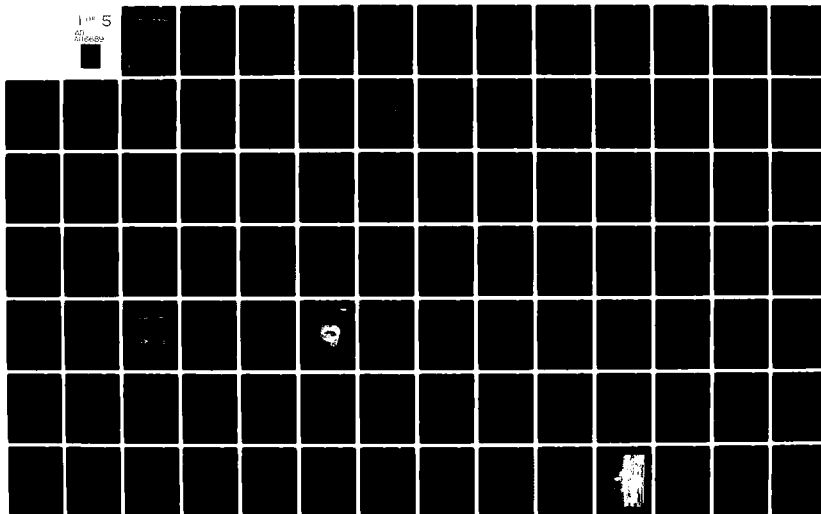
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# EMERGENCY PREPAREDNESS

A Handbook for Families

by

John R. Christiansen and Reed H. Blake

Final Report  
Contract EMW-C-0297  
Work Unit 4432E

June 1982

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Prepared for the Federal Emergency Management Agency

by

Brigham Young University

Provo, Utah 84602

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A HANDBOOK FOR FAMILIES

FINAL REPORT

by

John R. Christiansen

Reed H. Blake

Brigham Young University

for

Federal Emergency Management Agency  
Washington, D.C. 20472

Prepared Under Contract Number EMW-C-0297

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Most common emergencies can be prevented through careful application of knowledge. Some emergencies faced by general populations cannot be prevented, but careful preparation can markedly reduce their destructive impacts. This manual is designed to provide knowledge to the general population of the United States which may be used to plan and prepare for emergencies of many kinds. This handbook provides an overview of the types of common and relatively uncommon emergencies that have been, or might be, faced by the general population of the		



United States. It also provides information regarding effective emergency planning for families and households, and ties in that planning to those civil organizations most likely to be involved in those emergencies. Families and households are instructed about the kinds of decisions and actions which will be taken by governments, and given the information for making decisions of their own which will be complemented by governmental programs. The general thrust of the manual is to provide citizens with the knowledge to become so self-sufficient that they can not only help themselves but help others in greater need during emergencies, including providing volunteer help to local governments so as to make programs which might have to be utilized in general emergencies work well.

## Abstract

Many emergencies can be prevented. Nearly all impacts resulting from emergencies can be effectively ameliorated by prior preparation and planning. This handbook provides citizens with the knowledge to plan and prepare for dealing with most emergencies. It likewise informs them of actions which governmental and private agencies are likely to take in emergencies, thus helping citizens to improve their chances of survival and minimize threats to themselves and their property. Procedures for assisting others, either individually or through volunteer work with agencies, is also given.

### Key Words

Emergency preparedness, crisis, civil defense, natural disaster, man-made disaster, nuclear emergency, biological threats, chemical threats, crisis planning.



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## PREFACE

The Federal Emergency Management Agency (FEMA) was established in 1978. Among the "principles" enunciated in the Presidential Plan which initiated the Agency was the following:

The communications, warning, evacuation, and public education process involved in preparedness for a possible nuclear attack should be developed, tested, and used for major natural and accidental disasters as well.

As a result of these instructions, FEMA has supported development of public education and training materials for emergency preparedness. In particular, FEMA has attempted to assess the requirements for protecting the public from all hazards, natural, man-made, and nuclear, and to provide those requirements. One method of providing such general protection is to develop the capability of moving vast populations away from danger zones to more protected environments.

Over the past eleven years, Brigham Young University has conducted research to explore the feasibility and means of relocating the general public from areas which have high-risk potential to shelters in areas of negligible risk. Field-tests conducted in Western Colorado have shown that procedures developed for "crisis relocation" are practicable even when they provide for sheltering the relocated population in private residences. Contrary to prevailing ideas, not only would the public welcome relocated persons into their homes in emergencies, but would volunteer to assist in sufficient numbers to make that process workable.

Needed guidelines for both relocated persons, and those taking them into their private residences has been lacking, however. This handbook has been developed under the direction of FEMA to meet that need.

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## EXECUTIVE SUMMARY

This handbook has been written to assist families in dealing with life-threatening emergencies. More specifically, the handbook provides information relative to a wide variety of common emergencies and also nuclear emergencies. Such information should not only help individuals to cope with common and more unusual crises but also enable them to help other individuals and families who may be threatened.

Usually life-threatening situations affect a minority of people. At such times, local organizations, both public and private, are called upon. In the United States, most communities, counties, cities, and states have ample resources to alleviate the suffering and want of the minority of those in perilous situations. If those organizations and agencies cannot provide sufficient assistance, the Federal Government may assist as well. Time and time again, the Federal Government has assisted state and local governments in dealing with emergencies, often cooperating with private organizations in doing so. In addition, the Federal Government has assisted other countries whose own resources were not adequate to deal with calamities.

When, however, emergencies become so big that most people living in large areas are affected, the best efforts of private and governmental organizations alike may not be sufficient to deal adequately with all the people involved. When that happens, it has been the general rule for Americans to become actively involved in helping those less

fortunate than themselves. In Midwest snowstorms, in Gulf-states hurricanes, in Rocky Mountain floods, in West Coast fires, and elsewhere, help has been given to those in peril and who are left homeless. This altruistic value is so deeply a part of American life that most victims in large-scale disasters are helped through private, rather than governmental means, at least initially. For example, in most Gulf-state hurricanes, approximately 75 percent of evacuated populations find private housing, while about 25 percent are provided for in public facilities.

This expression of concern for others by the public is so general in the United States, and is so strong and so quickly initiated, that most life-threatening situations are quickly reduced to inconveniences when coupled with the long-term help of private and government agencies.

With this in mind, part of the survival plans of the United States for major disasters--those which involve major redistribution of the population--incorporate into them the unique capacity and willingness of the public to help one another. In the event of a nuclear crisis, for example, it is most likely that there will be a sufficient warning of coming danger that evacuation of most people living in large cities and other threatened places could be carried out. While most people might be sheltered in public places such as schools, government buildings, and offices, in such "Crisis Relocation Plans," many would be able to find shelter in private homes where the protection would be about as great, and the convenience and resources perhaps even greater.

That most owners of private residences would welcome such relocated persons--even in the most severe emergency now considered possible, a nuclear attack--has been confirmed by research at Iowa State, Michigan

State, and particularly by surveys conducted by Dr. Jiri Nehnevajsa of the University of Pittsburgh. Further, field-tests conducted by Brigham Young University indicated the majority of persons having homes suitable as shelters were willing to share them during major crises.

Those field tests also indicated there were serious concerns about the lack of information for giving effective help to those who might come into one's home. Other inquiries made elsewhere indicated, too, that persons willing to make their homes available as life-saving shelters want information about dealing with sickness, injury, feeding, managing, and other matters which might confront them (as well as the disaster itself).

This manual attempts to deal with those needs by providing at least some information requested by potential sharers.

The handbook is divided into five major sections. The first of these, "Preparing for Common Emergencies," describes the type of prior planning that should be done to deal with most emergencies, the kind of skills that need to be developed, and the supplies and social resources that should be obtained to effectively meet emergencies.

The second section, "Common Emergencies," gives a description of natural and man-made disasters that happen most frequently in the United States. Examples of each disaster are given as well as lists of specific things that ought to be done prior to each emergency. Likewise, a list of actions that ought to be taken during the occurrence of each emergency is given in order to reduce the hazards and losses that might otherwise take place.

Owing to the relative lack of information about nuclear emergencies, the next two sections, "Nuclear Threats" and "Nuclear

Disaster Preparedness," quite extensively deal with types of emergencies that have occurred only infrequently in the United States. Yet, because of increased international tensions, the development of more nuclear power sources, and the possibility of terrorism involving nuclear threats, these sections are considered to be vital. In these sections, an overview of the kind of threats that might occur are described, the role of government and private aid is outlined, and methods of dealing with various threats resulting from nuclear emergencies are reviewed.

The final section, "Responding to Emergencies," concerns information that pertains to both natural, man-made, and nuclear disasters heretofore not presented. More detailed instructions for dealing with counseling, fire suppression, first aid, and radiation decontamination are given. Moreover, information about repairing damage and helping others through shelters or general volunteer service is outlined.

## Part I

## Preparing for Common Emergencies

## INTRODUCTION

Most Americans have never experienced a large-scale disaster of any kind. Our society is well ordered. We control many of the potentially disruptive aspects in our environment so well that disasters do not affect large-scale populations. Accounts of disasters on television, radio, magazines, or newspapers are as close as many Americans come to them. Yet, disasters do happen. There have been enough of them that many Americans have experienced them--both natural and man-made.

Natural disasters have taken many lives and caused many injuries and distress to people during the past decade. Earthquakes have resulted in more than 750,000 deaths throughout the world. Floods and tidal waves take about 1,000 lives a year worldwide. Throughout the world more than 30,000 people are killed each year by typhoons, hurricanes, and other storms. In the United States alone, tornadoes result in more than 100 deaths each year. Other kinds of natural disasters, such as lightning-caused forest fires, cause further death and injury. Such disasters seem to be increasing in frequency, although better reporting may be the reasons for the presumed increase.

While the possibility that natural disasters may be occurring at an increasing rate may be debatable, the increasing incidence of man-made disasters leaves little room for debate. Man-made disasters are increasing at a significant rate. One reason for this is simply that there are more people on the earth to cause such disasters and to be affected by them as well as natural disasters. More specifically, the complexities of providing food, heat, clothing, and other necessities of

life for a world population of more than four billion people provides a setting in which man-made disasters, including nuclear war, can occur increasingly. This is particularly true considering the fact that the world's population is growing in ever increasing numbers.

It appears only prudent, therefore, to prepare for emergencies. Being prepared for all kinds of emergencies has many advantages, particularly if that preparation extends beyond federal, state, and local governments to private enterprises and even private families and households. If adequate emergency preparations were made at all these levels, the results of emergencies, whether they be individual or general, would be minimized. There would also be resources available by those most affected to help themselves, but there would be abundant resources to help others. In addition, psychological preparation would have been made to some extent while preparing material supplies and resources. Finally, an inventory of the availability of resources would be made and effectiveness improved among families as well as governmental and private agencies in dealing with these emergencies.

In this section of the handbook, basic plans and resources for dealing with all kinds of emergencies are discussed. Suggestions are given for preparing families with action plans and material resources for coping with emergencies.

## Chapter 1

## EMERGENCY PLANS

The difference in emergencies is preparation. Whether the unexpected and undesired event becomes life-threatening or merely inconvenient depends a great deal upon preparation. In this chapter, and in the six following chapters, guidelines for preparing for most emergencies are given. While most people recognize that having food, clothing, and medicines on hand for emergencies is desirable, few people recognize that having an emergency plan for the family or household is essential, too.

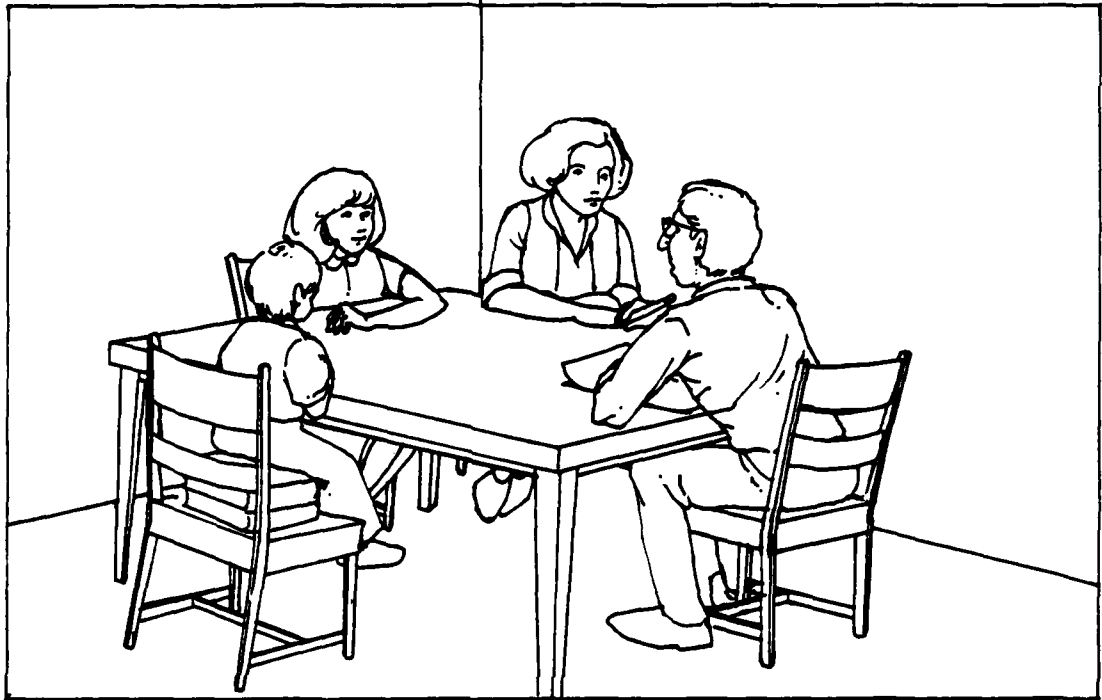
If a disaster were to occur in a community, various public and private agencies would try to give assistance. No matter how well-intentioned these agencies are, they cannot always respond with help as soon as *one would wish or with all the aid one might want them to give even under the best of conditions*. Under the worst of conditions, a family might be totally on its own for up to 72 hours. To avoid panic, to take appropriate actions, and to keep together, each family should have a Family Emergency Plan.

The Family Emergency Plan (FEP) should have instructions for dealing with emergencies:

1. When family members are together or apart.
2. Different kinds of emergencies.

Daily Schedule

The first element of a Family Emergency Plan should be a daily schedule for all members of the family. In some families, one



Making a Family Emergency Plan is the first step in both preventing, and responding to, disasters in an effective way.



person--often the homemaker--keeps track of most family members' activities. In other families, the schedule is not known by others. In emergencies the person who knows the schedule of the family may not be there. In any event it is important that each family member have a written schedule, and that this schedule be posted so that other members may become familiar with it. An example of such a schedule is shown on the following page.

If an emergency occurs, communication among family members is easier with a family schedule. All will know where missing family members are, when they will return, and how to get in touch with them.

#### Home Emergency Plan

Plans for dealing with various emergencies which may occur at home should be discussed and rehearsed until each member is fully aware of actions that should be taken. These plans should deal with such home emergencies as fire, personal injuries, power outages, flooding, nuclear attack, invasion of privacy, and storms. For each of these possible emergencies, a plan of action should be made and agreed upon. Each of these plans should outline:

- a. the nature of the threat,
- b. plan of action to be taken,
- c. resources available, and,
- d. recovery.

As an example of a Home Emergency Plan for fires, a listing of possible fire sources should first be prepared such as:

1. Electrical fire.
2. Gas explosion and fire.
3. Kitchen fire.
4. Furnace overheating and fire.
5. Fireplace or chimney-started fire.

Schedule of Joan Jones for the week of Feb. 6-12, 1984.

Time of day	Day of Week						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
AM							
6	Home	Home	Home	Home	Home	Home	Home
7	Spa	Spa	Spa	Spa	Spa	Home	Home
8	Commute	Commute	Commute	Commute	Commute	Home	Home
9	Office	Office	Office	Office	Office	Shopping at Mall	Church
10	"	"	"	"	"	"	"
11	"	"	"	"	"	"	Home
12	Lunch	Lunch	Lunch	Lunch	Lunch	Home	"
PM							
1	Office	Office	Office	Office	Office	"	"
2	"	"	"	"	"	Movie	Visiting family
3	"	"	"	"	"	"	"
4	"	"	"	"	"	"	"
5	Commute	Commute	Commute	Commute	Commute	Dinner Away	"
6	Home	Home	Home	Home	Home	"	Home
7	"	Church	Bowling	"	Red Cross	Race Track	"
8	"	"	"	"	"	"	"
9	"	"	"	"	Home	"	"
10	"	Home	"	"	"	"	"
11	"	"	"	"	"	Home	"
12	"	"	"	"	"	"	"

The Family Emergency Plan for fires might include a simple floor plan showing fire extinguishers, outside garden hoses that could be used to fight fires, telephones, smoke detectors, bedrooms and sources of fires. An example is shown on the following page.

The plan of action for each type of fire might be given such as this plan for an electrical fire:

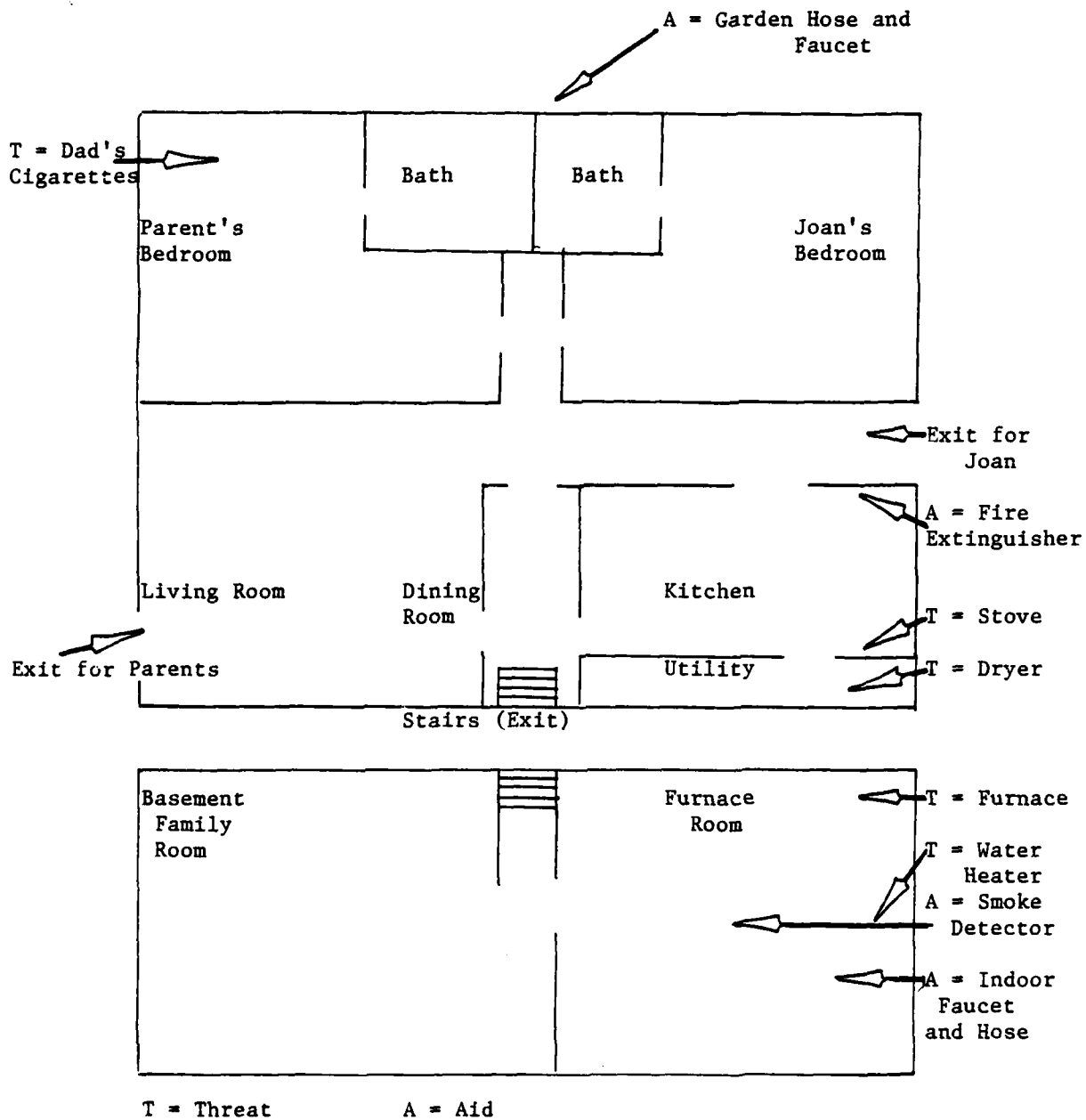
1. Mother--get baby and call the fire department using own phone, if possible, or neighbor's.
2. Father--shut off main electrical switch in house, if possible, and obtain fire extinguisher from kitchen closet.
3. Daughter--join mother, help with baby, and leave house with mother and baby, going to neighbor's.

In listing resources available for dealing with a house fire, the family might list the following:

- a. telephone
- b. fire department
- c. neighbors
- d. fire extinguishers
- e. blankets for extinguishing fires on persons or objects
- f. first-aid kit
- g. garden hoses available for use
- h. smoke detectors
- i. insurance.

These resources can then be put into the action plan.

The plans for recovery might include--in the case of an electrical fire--repairing the house, replacing the fixtures, rewiring the house, recovering costs through the fire insurance company, and dealing with any injuries.



Floor plan of residence showing potential sources of fire and the means of dealing with it in its first stages.

### Individual Emergency Plans

Each member of a family should have an individual plan for emergencies to use when he or she is away from the home. This plan should include:

- a. identification,
- b. outlines of actions to be taken depending upon the nature of the emergency,
- c. means of communicating and reuniting with the family.

An example of the kind of Individual Emergency Plan that could be used by a school-aged child is shown on the following page. Parents could have duplicates of their childrens' cards with them.

In the following chapters of this Family Survival Handbook, various options for dealing with emergencies will be shown. These include evacuation, use of home shelters or public shelters, and rendering assistance to others. Having this information and, where appropriate, emergency drills, should help families develop their emergency plans in ways that best match their own needs and resources.

## (Front of Card)

Name: John J. Jones  
Phone: (503) 323-8811  
Address: 456 Roseway Street, Weston, Oregon 87886  
  
Parents: Mr. and Mrs. James Jones  
  
Emergency Contact: Mr. or Mrs. Frederick Jones  
416 1st Avenue, #14  
Winchester, Kentucky 49391  
(606) 489-3721  
  
Medical Condition: Allergic to penicillin,  
Blood Type: A  
  
Religious Affiliation: Roman Catholic

## (Back of Card)

## Johnnie:

1. If school lets out, GO HOME.  
If kept at school, obey teacher. We will get you  
as soon as possible.
2. If you are taken to a shelter, call home as soon as  
you can. If you do not get an answer, call Uncle  
Fred COLLECT. We will find out where you are and  
get you as soon as we can.
3. If you are taken somewhere else, find a policeman,  
fireman, or teacher, and follow their directions.  
Call when you can.

Example of Individual Emergency Plan for Children in School

## Chapter 2

## COMMUNICATIONS

One of the most pressing needs for agencies and individuals during emergencies is to obtain and give reliable information. So intense is this need that during emergencies, telephone lines to police, fire department, and sheriffs' offices are often completely tied up with incoming calls. These agencies are sometimes not able to assist victims of emergencies because of the requests for information.

Fortunately most communities have other means of communication than the telephone. A list of public, private, and voluntary agencies who provide communication during emergencies is given below:

ORGANIZATIONS	FUNCTIONS/CHARACTERISTICS
Emergency Broadcast Service	<p>A network of AM radio stations formed to operate during war, threats of war, disasters, or other national emergencies.</p> <p>Provides residents with information released by officials.</p> <p>Provides information about events in other areas.</p> <p>Provides information about how to find necessary resources following a disaster.</p> <p>Provides information about radiological conditions in a disaster that involves nuclear materials.</p>

RACES (Radio Amateur Civil Emergency Services)	<p>A group of amateur short-wave radio operators authorized by the Federal Communications Commission to transmit information from state and local officials in a disaster.</p> <p>Can connect EOCs to outlying areas.</p> <p>Can connect EOCs at various levels of government.</p>
NEAR (National Emergency Aid Radio)	<p>An organization of Citizen's Band (CB) radio operators.</p> <p>Monitors emergency calls on the emergency CB channel.</p> <p>Relays messages and requests for aid to authorities.</p>
REACT (Radio Emergency Associated Citizens Teams)	<p>Monitors CB emergency channel (9) on a 24-hour basis.</p> <p>Responds to calls for help from motorists.</p>
TV/AM-FM Radio	<p>Provide up-to-date information in a crisis.</p> <p>Provide air time to officials who can tell the public what action to take.</p>
Newspapers	<p>Tell residents how to prepare for an upcoming disaster.</p> <p>Tell residents how to repair and restore a community after an emergency.</p>
National Weather Service	<p>Provides information about weather-related emergencies.</p> <p>Issues "all clear" signal after emergency has passed.</p>
Western Union	<p>Can provide teletype services to the EOC, the media, and to the National Weather Service.</p>



Roving Commercial Vehicles (taxis, buses, trucks, trains)	Relay damage reports and other information about the emergency to authorities.
Military Communication Systems (National Guard, Civil Air Patrol, and the four service branches)	Provide trained labor and modern communications systems to the community.

In addition to communication sources shown, there are other communication channels open as well. One of those is made up of volunteers who serve as messengers. Explorers, part of the Boy Scouts of America Organization, Red Cross volunteers, and members of civic groups all have been used as messengers during emergencies.

A general rule for citizens to follow during emergencies is NOT to use the telephone, but to tune into AM radio stations for local and up-to-date information about emergencies of all kinds, or television.

#### Outdoor Warning Systems

Many communities have outdoor warning systems involving whistles, sirens, horns, or other devices. The usual warning for threats other than attack is the "Attention" or "Alert Signal." This consists of a three-to-five minute steady blast. The purpose of this signal is to get the attention of people for a threatened or impending peacetime emergency such as a tornado, flash flood, or fire. In most places the Attention or Alert Signal means that people should turn on their radios or television sets to hear important emergency information being broadcast.

The outdoor warning signal for an attack is a wavering sound on sirens, or a series of short blasts on whistles, horns, or other devices. This signal will be used only to warn of an attack against the United States.

It is very desirable, therefore, for every family or household to have the means of receiving communication and giving it as well.

Priority items would include:

1. Battery-operated AM radio with extra batteries.
2. Mobile Citizens' Band radio; i.e., one that uses vehicle batteries for power.
3. Television set (battery-powered preferred).
4. Telephone.

(Family members should be instructed to act on official information rather than on rumor and speculation.)

## Chapter 3

## FOOD

It is highly possible that a community disaster or nuclear explosion could force a family to rely on its own food reserves until economic recovery occurs. Considering this possibility, the United States government recommends that all families store at least a two-week supply of food for such emergency use. In the event of a nuclear attack on the United States, a year's supply of food would be very desirable.

Two methods of home food storage for emergencies might be considered:

1. Increase the regular food purchases and processing so there will always be a reserve supply of food in the home. Replace food as it is used.
2. Store and maintain in a fallout shelter or home a special stockpile of survival foods. Choose foods that will keep for months without refrigeration, require little or no cooking, and yet will provide a reasonably well-balanced family diet.

It is generally desirable to use the first method of food storage listed above. Some advantages of doing so include the fact that the kind of food used is both palatable and familiar. Such food must be used more quickly than freeze-dried foods commonly used as "survival" foods, however. Survival foods may vary from a single cracker-type food, such as rye or wheat wafers or specially prepared biscuits, to a fairly complete assortment of familiar foods. Stockpile foods should be in cans, jars, or sealed paper or plastic containers. Select foods that will last for months without refrigeration and can be eaten with little or no cooking. Take into consideration the needs and preferences of family members, storage space, and ability to rotate the stored foods in

family meals. Familiar, well-liked foods are more acceptable in times of stress than strange foods.

See Table 1 for foods suitable for emergency storage. If a family consists of four adults, store four times the amount suggested in Table 1. Teenagers are likely to need more than the amount in the table, younger children less.

By including each day foods from the eight groups listed, family members can have a reasonably nutritious diet. Special types of milk and strained, chopped, or other specially prepared foods may be required for infants, toddlers, elderly persons, and others on limited diets.

Whenever possible, choose cans and jars in sizes that will fill a family's needs for only one meal. This is especially desirable for meat, poultry, fish, vegetables, evaporated milk, and other foods that deteriorate rapidly after a container is opened.

If the home food freezer is located in the basement or where there is safe access to it after a disaster or attack, you might count foods in it as part of the reserve supply. Food spoilage in a well-filled, well-insulated home freezer does not begin until several days after power goes off. Food in large freezers will keep longer than food in small freezers. Once the freezer has been opened, foods should be used as promptly as possible.

### Storage

To maintain the quality of your reserve food supply, keep canned foods in a dry place, where the temperature is fairly cool--preferably not above 70°F. and not below freezing.

Protect food in paper boxes from rodents and insects by storing boxes in tightly closed cans or other metal containers; leave the foods

Table 1.--Guide for Reserve Food Supply

Kind of food	Amount per person for--		Remarks
	1 day	2 weeks	
1. Milk	Equivalent of 2 glasses (fluid)	Equivalent of 7 quarts (fluid)	Each of the following is the equivalent of 1 quart of fluid milk: Evaporated milk: three 6-ounce cans; one 14½-ounce can. Nonfat dry milk or whole dry milk: 3 to 3½ ounces.
2. Canned meat, poultry, fish, cooked dry beans, and peas	2 servings	28 servings (8 to 9 pounds)	Amounts suggested for one serving of each food are as follows: Canned meat, poultry: 2 to 3 ounces. Canned fish: 2 to 3 ounces. Canned mixtures of meat, poultry, or fish with vegetables, rice, macaroni, spaghetti, noodles, or cooked dry beans: 8 ounces. Condensed soups containing meat, poultry, fish, or dry beans or dry peas: one-half of a 10½-ounce can.
3. Fruits and vegetables	3 to 4 servings	42 to 56 servings (about 21 pounds, canned)	Amounts suggested for one serving of each food are as follows: Canned juices: 4 to 6 ounces, single strength. Canned fruit and vegetables: 4 ounces. Dried fruit: 1½ ounces.

4. Cereals and baked goods	3 to 4 servings	42 to 56 servings (5 to 7 pounds)	<p>Amounts suggested for one serving of each food are as follows (selection depends on extent of cooking possible):</p> <p>Cereal: Ready-to-eat puffed: <math>\frac{1}{4}</math> ounce.  Ready-to-eat flaked: <math>\frac{3}{4}</math> ounce. Other  ready-to-eat cereal: 1 ounce. Uncooked  (quick-cooking): 1 ounce.  Crackers: 1 ounce.  Cookies: 1 ounce.  Canned bread, steamed puddings, and cake:  1 to 2 ounces.  Flour mixes: 1 ounce.  Flour: 1 ounce.  Macaroni, spaghetti, noodles: Dry: <math>\frac{3}{4}</math> ounce.  Cooked, canned: 6 ounces.</p>
5. Spreads for bread and crackers	According to family practices		<p>Examples: Cheese spreads. Peanut and other nut butters. Jam, jelly, marmalade, preserves. Syrup, honey. Apple and other fruit butters. Relish, catsup, mustard.</p>
6. Fats and vegetable oil	Up to 1 pound or two pints		<p>Amount depends on extent of cooking possible. Kinds that do not require refrigeration.</p>
7. Sugars, sweets, and nuts	1 to 2 pounds		<p>Sugar, hard candy, gum, nuts, instant puddings.</p>
8. Miscellaneous	According to family practices and extent of cooking possible		<p>Examples: Coffee, tea, cocoa (instant). Dry cream product (instant). Bouillon products. Flavored beverage powders. Salt and pepper. Flavoring extracts, vinegar. Soda, baking powder.</p>

Source: USDA, "Family Food Stockpile for Survival," Home and Garden Bulletin No. 77, 1977.

in their original boxes. Keeping these foods in metal containers also extends the length of time they can be stored.

To preserve the eating quality of the emergency food supply, it will be necessary to rotate foods--to use them before the end of their shelf life, and then replace them. As time approaches for the replacement of particular food items, it is a good idea to use the food in family meal plans. As items are used, replace them in the emergency storage with fresh supplies. It is wise to date these items with ink or marker. Place new items at the back of the storage area; keep older ones in front.

Replacement periods for various foods are given below. Eating quality was the first consideration in setting the maximum replacement periods given. Many food items will be acceptable for a much longer period if storage temperatures do not exceed 70°F. Most of the suggested foods would be safe to use after longer storage periods.

Milk:	Months	Cereals and baked goods:	Months
Evaporated . . . . .	6	Ready-to-eat cereals:	
Nonfat dry or whole dry milk,		In metal container . . . . .	12
in metal container . . . . .	6	In original container . . . . .	1
Canned meat, poultry, fish:		Uncooked cereal (quick	
Meat, poultry. . . . .	18	cooking or instant):	
Fish . . . . .	12	In metal container . . . . .	24
Mixtures of meat, vegetables,		In original paper pkg. . . . .	12
cereal products . . . . .	18	Hydrogenated (or antioxidant-	
Condensed meat-and-vegetable		treated) fats, vegetable oil	12
soups. . . . .	8	Sugars, sweets, nuts:	
Fruits and vegetables:		Sugar . . . will keep indefinitely	
Berries and sour cherries,		Hard candy, gum . . . . .	18
canned . . . . .	6	Nuts, canned . . . . .	12
Citrus fruit juices, canned. .	6	Instant puddings . . . . .	12
Other fruits and fruit juices,		Miscellaneous:	
canned . . . . .	18	Coffee, tea, cocoa (instant)	18
Dried fruits in metal container	6	Dry cream product . . . . .	12
Tomatoes, sauerkraut, canned .	6	Bouillon products . . . . .	12
Other vegetables, canned		Flavored beverage powders . .	24
(including dry beans and peas)	18	Salt . . . will keep indefinitely	

### Meal Plans

Even with limited varieties of food available, a family can eat nutritious, well-balanced meals. See Table 2 for suggested meal plans using stored food.

Half of the meals fit a situation where there are no cooking facilities. The other meals require facilities for heating water or food but not for any extended cooking.

The foods suggested are all fully cooked and safe for eating "as is" without cooking. Home-canned meats and vegetables may be eaten without cooking if the canning equipment was in good working order and recommended methods of canning were used. If there is provided a sufficient variety of canned foods in the reserve supply, it is possible to have reasonably well-balanced meals. However, because of limited space and in order to use fewer dishes, it may be more practical to serve fewer foods at a meal and make servings more generous.

### Equipment

It is desirable to have available certain equipment for emergency cooking and serving. Keep these items with the rest of the emergency supplies:

small, compact cooking unit (camp stove, etc.)	measuring cup
1 to 2 cooking pans	matches
disposable knives, forks, spoons	pocket knife
paper plates and cups	medicine dropper (for measuring water purifier)
paper towels, napkins	nursing bottles and nipples, if needed
can and bottle openers	cooking mitts or pads
cooking utensils (spatula, cutlery, spoons, etc.)	

Plan to use plastic dishes and cups, and ordinary silverware rather than disposable tableware. These would last for a longer period, would probably take less space to store, and would not require water for



Table 2--SAMPLE MEAL PLANS: No Cooking Facilities

First day	Second day	Third day
	MORNING	
Citrus fruit juice. <sup>1</sup> Ready-to-eat cereal. <sup>1</sup> Milk, cold coffee, <sup>2</sup> or tea. <sup>2</sup> Crackers. Peanut butter or other spread.	Fruit juice. <sup>1</sup> Corned beef hash. <sup>1</sup> Crackers. Spread. Milk, cold coffee, <sup>2</sup> or tea. <sup>2</sup>	Grapefruit segments. <sup>1</sup> Ready-to-eat cereal. <sup>1</sup> Vienna sausage Milk, cold coffee, <sup>2</sup> or tea. <sup>2</sup>
	NOON	
Spaghetti with meat sauce. <sup>1</sup> Green beans. Crackers. Spread. Milk, cold coffee, <sup>2</sup> or tea. <sup>2</sup>	Baked beans. <sup>1</sup> Brown bread. <sup>1</sup> Tomatoes. Fruit. Milk, cold coffee, <sup>2</sup> or tea. <sup>2</sup>	Chile con carne with beans. <sup>1</sup> Crackers. Fruit. Cookies. Milk, cold coffee, <sup>2</sup> or tea. <sup>2</sup>
	BETWEEN MEALS	
Fruit-flavored drink or fruit drink.	Milk.	Tomato juice.
	NIGHT	
Lunch meat. <sup>1</sup> Sweet potatoes. <sup>1</sup> Applesauce. <sup>1</sup> Milk, cold coffee, <sup>2</sup> or tea. <sup>2</sup>	Pork and gravy. <sup>1</sup> Corn. <sup>1</sup> Potatoes. <sup>1</sup> Instant pudding. Fruit juice.	Sliced beef. <sup>1</sup> Macaroni and cheese. <sup>1</sup> Peas and carrots Crackers. Milk, cold coffee, <sup>2</sup> or tea. <sup>2</sup>

<sup>1</sup> Canned. <sup>2</sup> Instant.

# SAMPLE MEAL PLANS: Limited Cooking Facilities

First day	Second day	Third day
	MORNING	
Citrus fruit juice. <sup>1</sup> Ready-to-eat cereal. Milk. Hot coffee, <sup>2</sup> tea, <sup>2</sup> or cocoa. <sup>2</sup>	Citrus fruit juice. <sup>1</sup> Hot cereal (quick-cooking). Milk. Hot coffee, <sup>2</sup> tea, <sup>2</sup> or cocoa. <sup>2</sup>	Prunes. <sup>1</sup> Ready-to-eat cereal. Milk. Crackers. Cheese. Hot coffee, <sup>2</sup> tea, <sup>2</sup> or cocoa. <sup>2</sup>
	NOON	
Vegetable soup. <sup>1</sup> Potato salad. Crackers. Ham spread. <sup>1</sup> Milk. Candy bar.	Beef-and-vegetable stew. <sup>1</sup> Green beans. Crackers. Peanut butter. Milk.	Chile con carne with beans. <sup>1</sup> Tomatoes. Crackers. <sup>2</sup> tea, <sup>2</sup> or cocoa. <sup>2</sup> Hot coffee, <sup>2</sup> tea, <sup>2</sup> or cocoa. <sup>2</sup>
	BETWEEN MEALS	
Fruit-flavored drink or fruit drink.	Tomato juice. <sup>1</sup>	Fruit-flavored drink or fruit drink.
	NIGHT	
Beef and <sup>1</sup> gravy. Noodles. Peas and carrots. <sup>1</sup> Instant pudding. <sup>2</sup> Hot coffee, <sup>2</sup> tea, <sup>2</sup> or cocoa. <sup>2</sup>	Tuna fish, <sup>1</sup> cream of celery soup, <sup>1</sup> mixed sweet pickles --combined in one dish. Fruit. Cookies. Hot coffee, <sup>2</sup> tea, <sup>2</sup> or cocoa. <sup>2</sup>	Lunch meat. <sup>1</sup> Hominy. <sup>1</sup> Applesauce. <sup>1</sup> Cookies. Peanuts. Hot coffee, <sup>2</sup> tea, <sup>2</sup> or cocoa. <sup>2</sup>

<sup>1</sup> Canned  
<sup>2</sup> Instant

Source: USDA, Home and Garden Bulletin No. 77, 1977.

washing. If disposable serving dishes and eating utensils are used, each family will need to estimate the number required for a two-week supply.

#### Finding food

It may become necessary in a disaster situation to provide food from nature's sources. Knowledge of a few simple skills and rules for getting food in the wild could mean the difference between eating and starving to death.

Maximizing your food supply. In a situation where one may soon face taking all meals from environmental sources, follow these guidelines to "stretch" the amount of food already at hand.

1. If you have less than a quart of water daily, avoid dry, salty, starchy, and highly flavored foods and meat. Keep in mind that eating increases thirst. Best foods to eat are those with high carbohydrate content, such as fruit bars.
2. All work you do requires additional food and water. Remember, the less work performed, the less food and water you will need.
3. You can live many days without food if you have water. When water is no problem, drink more than a normal amount to keep fit.
4. Always be on the lookout for wild foods. Eat off the land whenever possible. Save rations for emergencies.
5. Eat regularly, if possible; don't nibble. On limited rations, plan for one good meal daily; then sit down and make a feast of it. Two meals a day are preferable, especially if one of them is hot. In collecting wild foods, plan a hot meal. Cooking makes the food safer, more digestible, and more palatable. The time spent cooking will provide a good rest period.
6. Native foods may be more appetizing if they are eaten by themselves. Mixing rations and native foods usually does not pay.

Wild Foods. People should be able to find something to eat wherever they are. One of the best hunting grounds for survival food is

along the sea coast, between the high and low water mark. Other likely spots are the area between the beach and a coral reef; the marshes, mud flats, or mangrove swamps where a river flows into the ocean or into a larger river; riverbanks, inland water holes, shores of ponds and lakes; margins of forests, natural meadows, protected mountain slopes, abandoned cultivated fields. Poorest hunting grounds are high mountain tops, dry ridges, and dense, continuous forest stands.

Learn to overcome prejudices. Foods that may not look good to eat may be deceiving. Wild foods are good foods, with high vitamin and mineral content. Fleshy-leafed plants make good salad greens, and fresh fruits can provide fluid when water supplies are low. Eat enough to satisfy your hunger.

With a few exceptions, all animals are edible when freshly killed. Don't eat toads. Never risk human life with questionable seafood. Never eat fish with slimy gills, sunken eyes, flabby flesh or skin, or an unpleasant odor. If the flesh of a fish remains dented when the thumb is pressed against it, it is probably stale.

Animal food. Animal food will provide the most food value per pound. Anything that creeps, crawls, swims, or flies is a possible source of food. People eat grasshoppers, hairless caterpillars, wood-boring beetle larvae, and pupae, ant eggs, and termites. Such insects are high in fat. Most people have probably eaten insects as contaminants in flour, corn meal, rice, beans, fruits, and greens.

Hunting. Most warm-blooded, hairy animals are wary and hard to catch. To hunt them requires skill and patience. The best method for a beginner is "stand hunting." Find a place where animals pass--a trail, water place, or feeding ground. Hide nearby, always downwind, and wait for game to come within range. Remain absolutely motionless. It is

possible to stalk an animal upwind by moving very slowly and noiselessly, or "still hunting" keeping under cover as much as possible. Move only when the animal is feeding or looking the other way. Freeze if he looks in your direction.

The best time to hunt is either in the very early morning or dusk. In your travels, keep alert for animal signs such as tracks, trampled underbrush, or droppings. On narrow trails, be ready for game using the same pathways.

Game is most plentiful and most easily found near water, in forest clearings, or along the edge of thickets. Many animals live in holes in the ground or in hollow trees. Poke a flexible stick into the hole to determine if it is inhabited. Use a stick to tease the animal into running out after closing off other exits. Animals in hollow trees can be smoked out by building a fire at the base of the tree; be ready to club the animal as it flees.

Night hunting or fishing is often profitable, as most animals move at night. Use a flashlight or make a torch to shine in the animals' eyes--this partially blinds them, and you can get much closer than you normally could in daylight. If a gun is not available, try using a club or sharpened stick to kill the animal.

Remember that large animals when wounded or with their young can be dangerous. Be sure that the animal is dead before getting too close.

Along river and lake shores, small, fresh-water turtles can often be found sunning themselves. If they dash into shallow water, it is still possible to get them. Watch out for mouth and claws. Frogs and snakes also sun and feed along streams. Use both hands to catch a frog--one to attract it and keep it busy while grabbing it with the

other. All snakes, excepting sea snakes, are good to eat; use a long forked stick to catch them.

Both marine and dry-land lizards are edible. Use a baited noose or a fine fish-hook baited with a bright cloth lure, or use a slingshot or club.

Don't overlook birds and their nest. All bird eggs are edible when fresh, even with embryos. Large wading birds, such as cranes and herons, often nest in mangrove rookeries or in high trees near water. Ducks, geese, and swans are to be expected in tundra areas. During the moulting season these birds can be clubbed. Sea birds along low coast-lines frequently nest on sand bars or low sand islands. Steep, rocky coasts are favorite rookeries for gulls and auks. Catch birds at night when they are roosting.

Snares, traps, and deadfalls. It is possible to catch animals and fish using snares or traps. All snares and traps should be simple in construction, and may be set in game trails or frequently used runways, identified by fresh tracks and droppings. Any spot used as a butchering place attracts other animals; it is a good place to wait for game. Use entrails for bait.

Place traps where the trail is narrow. Arrange pickets, brush, or obstacles in such a manner as to force the animal to pass through the snare. Be sure the loop is large enough for the head to pass through but not so large that the body will go through. Disturb natural surroundings as little as possible.

Small rodents may be snared in any area with a string noose laid around a hole or burrow. Concealment can be attained by lying flat on the ground a short distance away. Jerk the noose tight when the animal pops his head out or steps into the noose.

The twitch-up snare--a noose attached to a sapling--jerks the animal up into the air, kills him promptly and keeps his carcass out of reach of other animals. This type of snare is not recommended for very cold climates, since the bent sapling may freeze in position and will not spring up when released.

Medium to large animals may be captured in deadfalls, but this type of trap is recommended only where big game exists in such quantities to justify the time and effort spent in construction. Build the deadfall close to a game trail, beside a stream, or on a ridge. Take care to see that the fall log slides smoothly between the upright guide posts and that the bait is placed at a sufficient distance from the bottom log to insure time for the fall log to fall before the animal can withdraw its head. In a trip-string deadfall, no bait is used. The log is tripped by the animal touching a trip string set across the trail.

Fishing. A hook and line are all that is necessary for fishing. Use insects, shellfish, worms, or meat for bait. Try to discover what the fish are eating. Artificial lures can be made from pieces of brightly colored cloth, feathers, or bits of bright metal. A length of wire between the line and hook will prevent a fish from biting the line in two. If the fish won't take bait, try to hook them in the stomach as they swim by.

If needed, improvise hooks from wire, or carve them out of bone or hard wood. It is possible to make a line by unraveling a rope or by twisting threads from cloth or plant fibers.

Better and more efficient than a line is a net. Attach poles at each end and work it up or down stream as rapidly as possible, moving stones and threshing the bottom or edges of stream banks. Gather up the net quickly every few moments so the fish will not escape. Use a gill

net in absolutely quiet water of lakes or streams; stones may be used as anchors and wood for floats; set the gill net at right angles to shore.

Fish traps or weirs are very useful for catching both fresh and salt water fish, especially those that move in schools. In lakes or large streams, fish tend to approach the banks and shallows in the morning and evening. Sea fish, traveling in large schools, regularly approach the shore with the incoming tide, often moving parallel to the shore and guided by obstructions in the water.

A fish trap is basically an enclosure with a blind opening where two fencelike walls extend out, like a funnel, from the entrance. The time and effort put into building a fish trap should depend on the need for food and the length of time available to stay in one spot.

Pick your trap location at high tide; build at low tide. One to two hours of work should do the job. Consider the location and try to adapt natural features which will reduce the amount of labor involved.

On rocky shores, use natural rock pools. On coral islands, use natural pools on the surface of reefs by blocking openings as the tide recedes. Avoid "boilers" along the surf. On sandy shores, use sand bars and the ditches they enclose. The best fishing off sandy beaches is in the lee of offshore sandbars.

In small, shallow streams, set fish traps with stakes or brush set into the stream bottom or weighted down with stones so that the stream is almost blocked except for a small, narrow opening into a stone or brush pen of shallow water. Wade into the stream, herding the fish into the trap. Catch or club them when they get into shallow water. Mud-bottomed streams can be trampled until roiled, then seined. the fish are blinded in the cloudy water and cannot avoid the nets.



Plant food. There are at least 300,000 different kinds of wild plants in the world. A large number of them are potentially edible, although some are more tasty and palatable than others. Under survival conditions, the kinds of wild plant and animal foods available will control and possibly require the altering of a diet almost completely. Plants are more common than animals, so use them all. However, it is necessary to have some practical knowledge of wild edible and poisonous plants, where they grow, and how to use them.

Educibility guidelines:

1. Never eat large quantities of a strange plant food without first testing it.
2. Take a teaspoonful of the plant food, prepared in the way it is to be used (raw, boiled, baked, etc.), hold it in your mouth for about 5 minutes. If, by this time no burning sensation or other unpleasant effect has occurred, swallow it. Wait for 8 hours. If you experience no ill effects such as nausea, cramps, or diarrhea, eat a handful and wait another 8 hours. If no ill effects occur by the end of this period, you may consider the plant edible. (Keep in mind that any new or strange food should be eaten sparingly until you have become used to it.)
3. An unpleasant taste does not, in and of itself necessarily mean that a plant is poisonous. (A disagreeable taste in a food item, which is otherwise safe to eat, may sometimes be removed by leaching, i.e., pouring cold or hot water through the chopped, crushed, or ground material. If cooking is possible, boiling in one or more changes of water may remove the unpleasant taste.)
4. A burning, nauseating, or bitter taste is a danger signal.
5. A small quantity of even poisonous food is not likely to prove fatal or even dangerous, whereas a large quantity may be.
6. Mushrooms can be very deadly, even in small amounts, and are best avoided completely.
7. In general, it is safe to try foods that you observe being eaten by birds and mammals, with some exceptions. Foods eaten by rodents (mice, rats, rabbits, beavers, squirrels, muskrats), or by bears, raccoons, and various other omnivorous animals are usually safe for you to try.

8. Cook all plant foods when in doubt about their edibility.
9. Avoid eating untested plants with milky juice or letting the milk contact your skin.

Foods from plant sources may include fruits, seeds, bark, tubers, buds, leaves, flowers, sap, pods, nuts, stems, rootstalks, shoots, and bulbs. All parts of some plants are edible, but for most types it is necessary to select the most palatable part.

One may eat the inner bark from numerous trees either raw or cooked. In famine areas, people make flour from the inner bark of trees. The thin, green, outer bark and white, innermost bark are normally used for food. The brown bark ordinarily contains bitter tannin.

Among trees with bark that is used as a source of food are the poplars (including cottonwoods and aspens), birches, and willows. The inner bark and growing tips of a few species of pine can also be used. The outer bark of these pines is scraped away and the inner bark stripped from the trunk and eaten fresh, dried, or cooked. It may also be pulverized into flour.

Grasses may serve as the most important single source of survival food. Some common varieties include rye, wheat, and oats. In general, grasses have an abundance of seeds, which may be eaten boiled or roasted after separating the chaff from the seeds by rubbing. To gather grass seeds, place a cloth on the ground and beat the grass heads with sticks (winnowing).

No known grass is poisonous. If the kernels are still soft and do not have large stiff barbs attached, boil them for porridge. Many grass seeds pop like popcorn--try them out by heating in a closed vessel.

Vegetables are produced mostly from succulent leaves, pods, seeds, stems, and nonwoody roots. Select young tender kinds, but cook all vegetables, particularly those in the tropics or those obtained from cultivated fields. Cooking will normally destroy all injurious intestinal parasites and bacteria.

Poisonous mushrooms and fungi cannot be detected by unpleasant taste or disagreeable odor. Edible fungi would contribute little food value and are easily enough confused with poisonous types that they should be disregarded as food sources.

Two common edible water plants are the cattail and the water lily. Cattails can be found in the more moist areas of desert regions and in the temperate zones. The young shoots may be eaten, and taste much like asparagus. The rootstalks, without their outer covering, can be eaten boiled or raw. If the plant is in flower, the yellow pollen may be mixed with water and formed into small cakes, and then steamed as a sort of bread.

Water lilies in the temperate zone produce enormous rootstalks and yellow or white flowers that float on the surface of the water. Rootstalks and tubers may be difficult to obtain because of deep water, but their food value is worth the effort to get them. They may be eaten raw or boiled.

Seaweeds are edible in small portions, and may be used in flavoring other foods. Choose only plants attached to rocks or floating free--do not use plants stranded on the beach.

#### Food Preparation

Various methods of preparation can contribute much in the way of taste and safety of consumption of wild foods. Proper methods of

preparation and care are particularly important in the case of wild meat.

Skinning and dressing.

1. It is important to dress big game animals immediately after the kill. This entails opening the body cavity and removing the internal organs--this permits the carcass to cool as quickly as possible, an important factor in the taste and freshness of the meat.
2. Dressing large game:
  - a. Turn the animal on its back, with its head uphill if possible. You may find it helpful to anchor the body with rocks or by tying it with legs spread apart.
  - b. With a sharp knife, begin cutting through the skin at the tailbone, cutting around the anal area in a circle. Cut slowly, lifting the skin with the first two fingers of your free hand as you guide the knife up the body cavity.
  - c. Cut through the skin, but not the enclosing membrane as you travel up the body. Be careful not to cut the bladder or intestines or you will taint the meat.
  - d. The diaphragm is a body of tissue which separates the abdominal organs from the heart and lungs. Cut around it near the ribs to loosen.
  - e. In deer-sized animals, you may now reach up and cut off the windpipe and gullet as high as you can reach. With larger game you will first need to split the ribs with a hatchet or an axe.
  - f. Firmly grasp the windpipe and gullet and pull back hard. By alternately pulling, and cutting when necessary, you can thus strip the entire insides from the carcass.
  - g. When you reach the pelvic area, you will need to finish cutting free the rectum from the body. Cut from the inside of the carcass and pull through.
  - h. Dispose of unneeded body organs. Fat may be saved for cooking purposes. Entrails may be used as bait. Save the heart and liver.
  - i. You will need to remove the musk glands from the hind legs of large game. Wash hands thoroughly afterward.
  - j. Now wipe any traces of blood and other body fluids from the meat with a dry rag, leaves, or moss.
  - k. In warm weather you will need to quarter large game in order to cool the meat properly. Break the backbone between the first and second ribs with an axe, and then

cut in half lengthwise. Chop the backbone lengthwise and through the pelvic bone on the rear half.

1. Hang the carcass head down in a cool, breezy area from two to fourteen days to allow the meat to cool. Remove meat you need to use immediately for food, leaving the rest on the carcass to cool and preserve for later use. (Outdoorsman's Handbook, J. Knap, pp. 157, 159.)
3. Skinning large game:
  - a. It is easiest to skin while the animal is still warm.
  - b. Cut off the legs just below the knee and hock joints.
  - c. Cut through the skin.
  - d. The skin can now be cut and peeled away from the body fairly easily.
4. Dressing small game:
  - a. Cut off the head, feet, and tail.
  - b. With the animal lying on its front, slit the skin from the back of the neck to the root of the tail.
  - c. Grasp the carcass inside the skin and pull the skin from it with your free hand. It should come away easily in one piece.
5. Birds:
  - a. To skin, simply cut the breast skin and peel.
  - b. To pluck, scald for 20 seconds in about 145° water. Then pluck feathers in small bunches from the body, pulling in the direction of their growth. Plucked birds will usually prove tastier than birds which have been skinned.
  - c. To gut, find a forked tree branch about the thickness of a pencil. Break one of the extensions from the fork so that you have formed a hook. Cut a slit near the anus, insert your hook deeply into the body, and twist it around several times. Pull out the entrails.
6. Fish:
  - a. Scale with a pocketknife, working from head to tail.
  - b. Immediately after landing a fish, bleed it by cutting out the gills and large blood vessels that lie next to the backbone.
  - c. Cut out the anus and remove.

- d. Sever the spine just behind the head.
  - e. Push and twist on the head with one hand, while pulling on the body with the other. The head should detach with all of the entrails with it.
  - f. Remove fins and wash.
7. Shell food:
- a. Leave clams, oysters, mussels, crabs, etc., in clean water overnight, and they will clean themselves.

### Cooking

Cooking makes for a more enjoyable, and often healthier, meal. All wild game, fresh water fish, clams, mussels, snails, and crayfish must be thoroughly cooked for safety. Raw or smoked fresh water fish are frequently contaminated with tapeworm and lung fluke parasites which are destroyed through cooking. Plant foods are more digestible and palatable after cooking.

Boiling, roasting, baking, and frying--in that order of preference--are efficient methods of preparing foods. Pit cooking or clambake style (oven) is slower but requires less attention, protects food from flies and other pests, and reveals no flame at night.

Ordinarily, water used to boil plant roots, tubers, or seeds can be used to make a good broth with the addition of sea food or meat.

To give taste to stews, add wild onions, succulent stems, and leaves of plants. Prepare seaweed for seasoning by washing, drying in the sun on a rock, grinding into bits, and sprinkling on food.

Fruits--Succulent fruits are best boiled. Large, tough, or heavy-skinned fruits are best baked or roasted.

Potherbs (greens)--Boil leaves, stems, and buds until tender. Several changes of water with subsequent rinsing will help eliminate bitter juices or undesirable tastes.

Roots and tubers--These can be boiled, but are most easily baked or roasted.

Nuts--Most nuts can be eaten raw, but some such as acorns are better cooked. Acorns should be broken up, boiled with ashes from the fire to eliminate tannin, moulded into cakes and then baked.

Grains and seeds--Parch (roast) grains and seeds to make them more digestible and tasty.

Sap--The sap of plants containing sugar can be dehydrated to a syrup by boiling slowly for several hours to remove the water.

Cooking without utensils. Often it is necessary to prepare and cook wild foods when no utensils are available. This does not necessarily mean that one cannot cook as desired. The following suggestions should help.

Roasting--Coat fish, potatoes, fresh water mussels, and many other foods large in size with a layer of mud or clay, and roast them directly in the flames or coals of a fire. Loss of food by burning is thus reduced. One need not scale fish prepared in this way; peel off the skin with the baked clay when cooked.

Steaming--Foods small in size, such as small bird eggs, fresh water snails, or any other shellfish, may be cooked in quantity in a pit beneath the fire. Fill a small, shallow pit with food, after lining it or wrapping the food in plant leaves, or cloth. Cover the pit with a  $\frac{1}{2}$ - to  $\frac{1}{2}$ -inch layer of sand or soil, and build the fire directly over it. After sufficient cooking, rake the fire away and remove the food.

Some foods may also be steamed clambake style. Heat a number of stones in a fire, then allow the fire to burn down to coals. Place such foods as fresh water mussels (in their shells) directly on and between the stones, and cover the whole with plant leaves, grass, or seaweed and

with a layer of sand or soil. When thoroughly steamed in their own juices, clams, oysters, and mussels will have a gaping shell when uncovered; eat the food without further preparation.

Stone boiling--Fill a big container with water and food. Add hot stones until the water boils. Cover for about an hour with big leaves, or until food is well done.

#### Preserving Excess Food

Always carry extra food. Wrap soft berries or fruits in leaves to keep them intact. Carry shellfish, crabs, and shrimp in wet seaweed. Clean fish immediately; wash them well; carry them on a line over a pole.

Drying of various foods can prevent waste through spoilage, and can make a survival situation more secure, since there is not the worry about getting food each day.

Excess fish can be split (cut off the head and remove the backbone), spread apart, and cut thin. Then dry over smoke fires, spread on hot rocks, or hang from branches in the sun. If sea water is available, splash it on to salt the outside. Do not keep any seafood unless it is well dried and salted.

Meat can be preserved as dried "beef" or jerky (jerked meat), either over a slow fire or in the hot sun. Hang all drying meat high to keep it away from animals. Cover to prevent blow-fly infestation. If mold forms on the outside, brush or wash off before eating. In damp weather smoked or air-dried meat must be redried to prevent molding.

To preserve cooked animal food, recook it once each day, especially in warm weather.

Plant food can be dried by wind, air, sun, or fire with or without smoke. A combination of these can be used. The main object is to get



rid of the water. Plantains, bananas, breadfruit, tubers, leaves, berries, and most wild fruits can be dried. Cut them into thin slices and place in the sun. A fire may be used if necessary.

(Air Force Survival manual, pp. 2-37, 1-55.)

## Chapter 4

## LIGHT AND HEAT

When necessary people can remain healthy for several days in total darkness. However, most tasks are more manageable if at least some light exists, and, therefore, less chance for hysteria and fear develops. Fears tend to increase as disorientation takes place in those unused to living in darkness. It is advisable, therefore, to provide some means of light during emergencies.

Most Americans have experienced power outages and realize the importance of having on hand such light sources as:

1. Flashlights
2. Gasoline, kerosene, or butane-fueled lanterns
3. Candles
4. Matches
5. Cigarette lighters
6. Fireplaces
7. Stoves
8. Flares
9. Battery-powered vehicle lights

Electric Lights

In severe emergencies, particularly in the case of nuclear attack, public power systems fail. Many public shelters are not stocked with emergency lights. Therefore, only the flashlights and candles that people bring with them to public shelters will be available for personal use.

An electric light can be put together using a low amperage bulb (a small 12-volt bulb used in automobiles) and either a large dry-cell battery or a car battery. In making such a light remember:

- a. always use a bulb of the same voltage as the battery.
- b. use a small, high-resistance wire, such as telephone wire, if a car battery is used.

- c. connect the battery after the rest of the wiring has been done.
- d. use reflective material such as aluminum foil and mirrors to concentrate the light where needed.

Preparation can be made before an emergency by obtaining 12-volt bulbs, sockets, wire, and clips, together with large batteries so that a light source can be quickly assembled. Dry-cell batteries kept in refrigerators will keep satisfactorily for many months or even years.

### Lamps

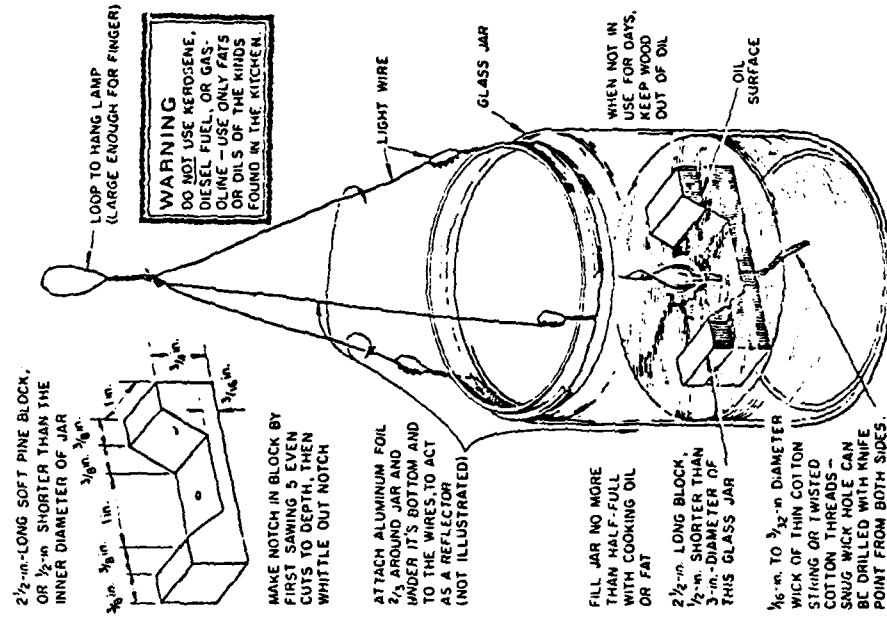
Gasoline and kerosene lamps should not ordinarily be taken inside a shelter. They produce gases that can cause headaches or even death. Moreover, if kerosene or gasoline lamps are knocked over accidentally or by blasts from detonations, the results could be extremely dangerous.

Experiments at Oak Ridge National Laboratory by Cresson Kearny have resulted in the development of "expedient lamps" much like those used by Eskimos for centuries. These lamps burn for about eight hours with only about one ounce of fat or cooking oil. They are relatively safe to use, and can be made in less than an hour. On the following page is a figure showing those lamps as explained in Kearny's Nuclear War Survival Skills.

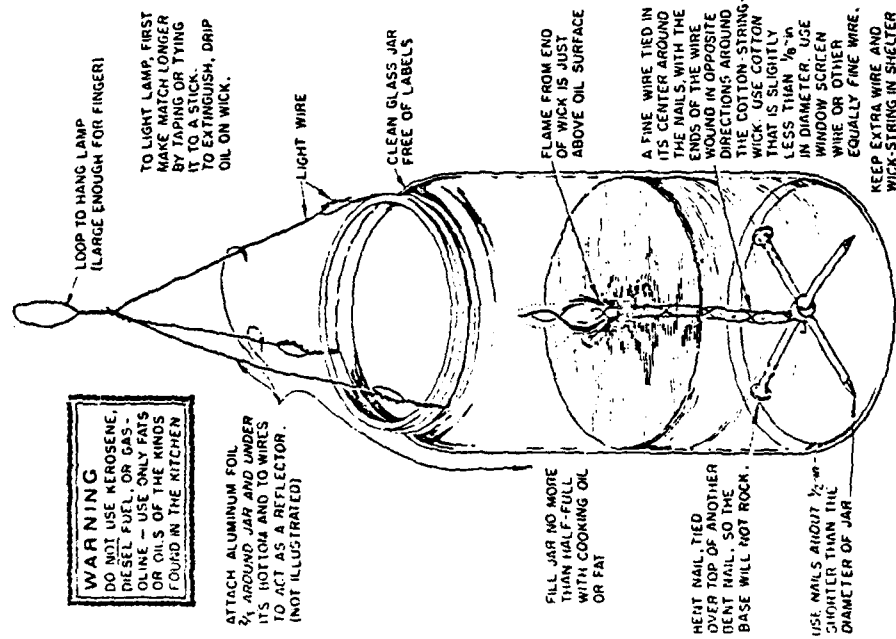
### Heat

In shelters, a lack of heat is usually not as great a problem as too much of it. Rather than heat entire shelters with fires or other heating equipment, it is generally preferable to provide warm clothing and sleeping materials for individuals. Otherwise, ventilation and overheating problems may occur.

Covering enough of your body with a thick layer of trapped or "dead" air is the basic requirement for keeping warm. Any material that



FLOATING WICK LAMP



WIRE-STIFFENED-WICK LAMP

separates air into spaces no more than one-eighth inch across is capable of keeping persons warm.

An outer windbreaker layer of clothing that is essentially airtight prevents the escape of warmed air and results in an insulating layer of trapped air. The best windbreaker materials permit very little air to pass through them, while at the same time allowing water vapor to escape.

Some general rules for keeping warm in cold weather are:

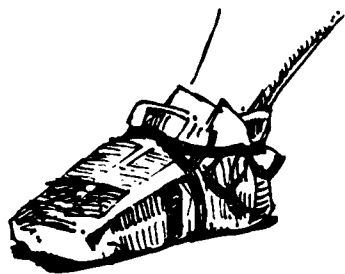
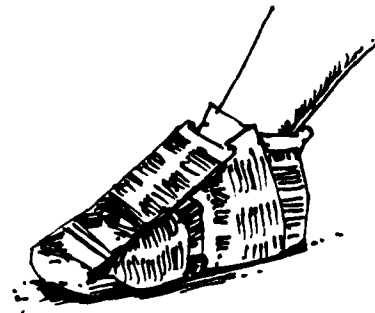
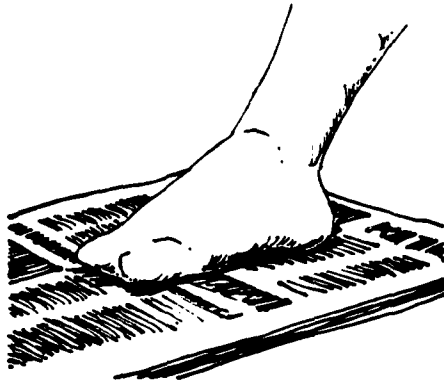
- a. keep your clothing clean and in repair. Clean clothes are better insulators than dirty clothes, and they last longer.
- b. your outer clothing should be windproof (not material through which breezes may be felt).
- c. avoid sweating--it is dangerous because it leads to freezing. If you are too warm, either slow down your rate of activity or take off some clothing.
- d. wear clothing loosely. Tight fits cut off circulation and increase the danger of freezing. Keep your ears covered by wearing hats or even improvised scarves or headgear.
- e. wear more socks, but do not put on so many that your feet feel tight.
- f. keep your clothing as dry as possible.

#### Improvised Clothing

As shown in the figure which follows, newspapers and other ordinary materials can be used to keep warm and stay healthy--even in much colder conditions than you might believe possible. A bath towel covered by a large paper bag, for example, will make warm headwear. Newspaper and plastic garbage bags can be used to cover legs, arms, and even the midsections of the body so that, while you may look like a large snowman, you will be warm in below-freezing weather.

In Nuclear War Survival Skills, Kearny gives the following ideas for keeping warm without fire:

1. If occupants of a cold room or shelter lack adequate clothing and bedding, all should lie close together.



This method of maintaining tolerable temperatures for the feet using newspapers can be applied to nearly all parts of the body.

2. Always place some insulating material between your body and a cold floor. (Pieces of shag rug are excellent.) Plastic film should be placed under the insulating material if the ground is damp.
3. Go to bed or put on all your body insulation before you begin to feel cold. Once the loss of body heat causes blood vessels in your hands and feet to constrict, it often is hard to get these vessels to return to normal dilation again.
4. Do not jump up and down and wave your arms to get or to keep warm. The windchill factor is a measure of air movement over your skin; rapid body movements always cause some such air movement. If practical, lie down and cover up; then do muscular tension exercises by repeatedly tightening all your muscles so tight that you tremble.
5. Prevent sweating and the dampening of insulation by taking off or opening up clothing as you begin to exercise, before you begin to sweat.
6. If you are getting cold, don't smoke. Nicotine causes blood vessels to constrict and the flow of blood to hands and feet to be reduced.
7. Don't drink an alcoholic beverage to warm yourself. Alcohol causes increased blood flow close to the skin surface, resulting in rapid loss of body heat. It is impossible for alcohol to make up for such loss for very long.

### Cooking

If electrical circuits are still functioning, cooking and heating can be done safely with electric stoves or small electric appliances. Such cooking and heating produces no harmful fumes and few problems for ventilation. On the other hand, if electricity is not available, gasoline or kerosene stoves may be used if ventilation is adequate. Remember, these stoves not only produce toxic gases, but take life-sustaining oxygen out of the atmosphere. The same is true for charcoal stoves, coal, paper, and wood burning stoves.

A type of paper-burning stove that can be used and assembled in emergencies, if a conventional stove is not available, is a "bucket stove." This can be made by using an ordinary metal (not plastic) bucket, utilizing crumpled-up newspaper as a fuel. If some oil is used on the newspaper, the fuel will last longer. An elaborate emergency

stove of this type is shown in the following figure. Remember, however, that such a stove has the common disadvantages of toxicity and oxygen consumption common to all stoves using open fire as a source of heat.





## Chapter 5

## MEDICAL SUPPLIES

During a community disaster or emergency, it is possible that professional medical aid will be unavailable for a long time. Survival may be a matter of prior preparation, self-sufficiency and skill. Families may have to doctor themselves.

In view of this possibility, a first-aid kit is obviously an essential addition to your store of emergency supplies. The medical aids suggested in this chapter are very basic, yet they could prove invaluable.

Emergency medical supply kit:

Adhesive tape, roll 2" wide	Nose drops (water soluble)
Applicators, sterile, cotton-tipped	Petroleum jelly
Antiseptic solution	Rubbing alcohol
Antibiotics (prescribed)	Smelling salts
Aspirin tablets	Safety pins, assorted sizes
Bandage, sterile roll, 2" wide	8 oz. table salt
Bandage, sterile roll, 4" wide	Sanitary napkins
Bandages, large triangular (37" x 37" x 52")	Scissors
	Soap
Bandages, plastic strips, assorted sizes	4 oz. baking soda
	Splints, wooden (18" long)
Cough mixture	1 package paper tissues
Diarrhea medication	Toothache remedy

Ear drops

Thermometer

Laxative

Tweezers

Medicine glass

Water purification materials

Motion sickness tablets

Plastic garbage bags

You may find that you already have many of these items in your home. Purchase those suggested items that you do not have now. Most are inexpensive and readily available at any drugstore.

In addition to the medical supplies listed on the previous page, it is suggested that you also have with you a first-aid manual and a home nursing handbook. Also, if certain members of your family take prescribed medication on a regular basis, it is recommended that you store at least a 100-day supply. Take into account the individual needs and susceptibilities of the members of your family in considering any extra items to include in your supply.

## Chapter 6

## SOCIAL RESOURCES

Before, during, and after any emergency there are many agencies, organizations, and other social resources that can provide help to families, households, and individuals. In fact, if there is any kind of experience which elicits an outpouring of aid and support from individuals and organizations alike, it is an emergency. Therefore, it is useful to consider what kind of help might be received, if needed, from others.

Planning, Coordination, and Control

While Federal and state agencies are likely to be involved in large-scale emergencies, coordination of most efforts in emergencies will be done on a community level. The mayors of large and small cities and communities together with city councils will plan, coordinate, and control efforts to help the needy through both public and private means. They will be assisted by local civil defense coordinators, state, and Federal workers. As shown in Table 1, coordination of efforts in emergencies will be done by four major agencies. The "EOC" in the table refers to the "Emergency Operating Center" which is a place, usually a basement in a public building, where personnel of these agencies meet and direct efforts.

Table 1.--Listing of Agencies with Major Responsibilities for Planning, Coordination, and Controlling Emergency Aid, with a Description of Their Functions.

AGENCY	FUNCTIONS
Mayor and City Council	<ul style="list-style-type: none"> <li>- Assure that warnings reach the public.</li> <li>- Assure that emergency forces (police, fire, sanitation) can deal with the crisis.</li> <li>- Assess the seriousness of the emergency by gathering and evaluating damage reports.</li> </ul>
Local Civil Defense Coordinator	<ul style="list-style-type: none"> <li>- Inspects shelters.</li> <li>- Recruits, trains, and manages shelter staff.</li> <li>- Assures that the EOC is in order.</li> <li>- Inspects and tests warning signals.</li> <li>- Tests disaster plans with staff.</li> </ul>
State Civil Defense Agency	<ul style="list-style-type: none"> <li>- Activates the state Emergency Operating Center.</li> <li>- Designates state agencies to deal with the crisis.</li> <li>- Gathers and evaluates damage reports for forwarding to the governor and to federal agencies.</li> </ul>
Federal Agencies	<ul style="list-style-type: none"> <li>- Use all personnel, equipment, facilities, and other resources to support the efforts of the state and community.</li> </ul>

Source of this and other tables in this chapter: Far West Laboratory, Emergency Preparedness: A Manual for Explorers, San Francisco, California, 1981.

Public Works, Transportation, and Utilities

Many natural and man-made emergencies affect electric power lines, natural gas supplies, culinary water systems, garbage disposal services, and other utilities as well as transportation services and public works. Those agencies most directly responsible for restoring those services, making the necessary repairs, and supervising both their repair and the functioning are shown in Table 2.

Table 2.--List of Agencies Responsible for Dealing with Public Works, Transportation, and Utilities in Emergencies, Together with Their Functions

AGENCY	FUNCTIONS
Department of Public Works	<ul style="list-style-type: none"> <li>- Assesses damage.</li> <li>- Demolishes and shores up damaged buildings.</li> <li>- Removes debris.</li> <li>- Restores sanitation facilities.</li> </ul>
Utilities Service (water, gas and electric companies form a single agency to handle the crisis)	<ul style="list-style-type: none"> <li>- Restores, maintains, and operates water, gas, and electricity.</li> <li>- Provides utilities in support of emergency operations.</li> <li>- Allocates utilities according to local, state, and federal priorities.</li> </ul>
Transportation Service	<ul style="list-style-type: none"> <li>- Obtains and coordinates transportation resources (buses, trains, taxis, and trucks) required by other agencies.</li> </ul>

Table 2.--(Continued)

Federal Emergency Management Agency (FEMA)	<ul style="list-style-type: none"> <li>- Provides planning and financial assistance to state and local governments.</li> <li>- Helps communities plan for tornadoes, hurricanes, floods, and other weather-related disasters.</li> <li>- Helps communities identify and reduce the hazards of earthquakes and dam failures.</li> </ul>
American National Red Cross (ANRC)	<ul style="list-style-type: none"> <li>- Has a legal obligation to provide relief for disaster victims.</li> <li>- Links private relief organizations with the state's coordination and operations centers.</li> </ul>
National Guard	<ul style="list-style-type: none"> <li>- Helps remove debris and perform other duties, if so ordered by the governor.</li> </ul>
Private Sources of Aid	<ul style="list-style-type: none"> <li>- Personnel that can be called in to help in debris removal and the restoration of public services include: utility workers, construction workers, electricians, carpenters, plumbers, taxi and truck drivers, and municipal transportation drivers.</li> </ul>

#### Food, Shelter, and Financial Services

One of the most pressing needs in disasters is to feed and house people who are without food or shelter. Another is to set up a means of financial aid to those in need so that they may purchase needed items. The local, state, and Federal agencies most likely to help in meeting

these needs are shown in Table 3. Also shown are the functions these agencies perform.

Table 3.--Agencies Dealing with Food, Shelter, and Financial Services During Emergencies, and the Functions of These Agencies

AGENCY	FUNCTIONS
Local	
Emergency Services Welfare Coordinator	<ul style="list-style-type: none"> <li>- Coordinates the activities of all relief agencies that respond to a disaster.</li> </ul>
Local Housing Authority	<ul style="list-style-type: none"> <li>- Assesses the damage to private houses.</li> <li>- Works with federal and state officials to obtain financial aid and temporary housing.</li> <li>- Finds temporary housing for victims.</li> </ul>
American National Red Cross	<ul style="list-style-type: none"> <li>- Provides food, shelter, clothing, medical care, household furnishings, home repair, and occupational rehabilitation to disaster victims.</li> <li>- Provides services to families, including information about dead, missing, or injured persons.</li> </ul>



Table 3.--(Continued)

State	
State Civil Defense Coordinator	<ul style="list-style-type: none"> <li>- Coordinates all the activities of state agencies, including the provision of equipment, facilities, and personnel required for emergency welfare services.</li> <li>- Manages the Disaster Assistance Center (DAC) which is staffed by people from state and Federal agencies to help disaster victims get assistance.</li> </ul>
Board of Real Estate Brokers	<ul style="list-style-type: none"> <li>- Identifies vacant houses as well as land that is available for mobile or prefabricated homes.</li> </ul>
State Building Construction Bureau	<ul style="list-style-type: none"> <li>- Supervises the construction of mobile homes.</li> </ul>
State Unemployment Division	<ul style="list-style-type: none"> <li>- Offers unemployment benefits, (job placement and/or financial aid) to eligible residents.</li> </ul>
Federal	
Federal Energy Management Agency	<ul style="list-style-type: none"> <li>- Offers financial assistance in the form of housing, employment, or direct financial aid.</li> </ul>
U.S. Department of Housing and Urban Development	<ul style="list-style-type: none"> <li>- Provides temporary housing for needy residents.</li> <li>- Provides funds for repair of private houses.</li> <li>- Makes mortgage and rental payments for eligible individuals.</li> </ul>

Table 3.--(Continued)

Other Agencies	
National Voluntary Organizations Active in Disaster (NVOAD)	<ul style="list-style-type: none"> <li>- Coordinates the efforts of national agencies that respond to community needs with food, shelter, and other necessities.</li> <li>- Members include: ANRC, Ananda Marga, Boy Scouts of America, B'nai B'rith, Church of the Brethren, Christian Reformed World Relief, Goodwill Industries of America, National Catholic Disaster Relief Committee, the Salvation Army, Seventh-Day Adventists, Society of St. Vincent de Paul, and the Volunteers of America.</li> </ul>
Private Sources of Aid	<ul style="list-style-type: none"> <li>- Private individuals and organizations that could help include: hotel and restaurant managers, school cafeteria personnel, YMCA/YWCA staff, apartment house owners' associations, motel owners' associations, real estate brokers, banks and state and local bar associations.</li> </ul>

#### Health and Medical Services

Following major disasters, communities are often faced with challenging tasks relating to the health and medical needs of residents.

These tasks include:

1. Providing medical care for the injured and sick.
2. Controlling health hazards and diseases.
3. Providing for the identification and burial of the dead.
4. Dealing with psychological and emotional disorders among survivors.

Agencies that might be expected to deal with these medical and health needs, together with the services they provide are shown in Table 4.

Table 4.--Identification and Functions of Agencies Providing Emergency Medical and Health Services

AGENCY	FUNCTIONS
Local	
Department of Health	<ul style="list-style-type: none"> <li>- Handles sanitation, immunization, records of vital statistics, and public health nursing.</li> <li>- Establishes a central blood bank which collects, stores, and distributes blood.</li> <li>- Establishes a central coroner's office which collects, identifies, and buries the dead.</li> </ul>
American National Red Cross	<ul style="list-style-type: none"> <li>- Adds its services to existing community resources.</li> <li>- Coordinates the use of schools and other similar buildings as welfare or emergency care facilities.</li> <li>- Provides services to families, including information about dead or missing members.</li> </ul>
Department of Environmental Health	<ul style="list-style-type: none"> <li>- Sets up a command post to monitor chemical spills, air pollution, and infectious bacteria that may contaminate food and water supplies.</li> </ul>
Hospitals and Clinics	<ul style="list-style-type: none"> <li>- Devote all available personnel and resources to saving lives and caring for the sick and injured.</li> </ul>

Table 4.--(Continued)

Medical Professional Organizations	<ul style="list-style-type: none"> <li>- Draw up and distribute instructions for physicians.</li> <li>- Set up a central communication center for doctors and other medical personnel.</li> </ul>
Emergency Medical Technician (EMT)	<ul style="list-style-type: none"> <li>- Provide general medical technicians, including paramedics.</li> <li>- Provide EMT dispatchers.</li> <li>- Provide EMT personnel trained in the extraction of crash victims.</li> </ul>
Federal	
Federal Energy Management Agency (FEMA)	<ul style="list-style-type: none"> <li>- May provide assistance in the form of United States Army field hospitals, ambulances, and medical personnel.</li> </ul>
National Health Service Corps	<ul style="list-style-type: none"> <li>- Provides physicians and nurses for community health services.</li> </ul>
The MEDICAID Program	<ul style="list-style-type: none"> <li>- Provides for payment of medical care costs for welfare recipients who may be injured, left homeless, or otherwise affected by the disaster.</li> </ul>

Public Safety

One of the major fears that some people have of disasters pertains to the unruly and unlawful behavior of others. Fortunately, past experience has shown that relatively few persons are victimized by others during emergencies. Rather, the prevalent behavior is one of caring respect for other persons' rights and property.

One reason why people continue to be law-abiding in emergencies is that public safety agencies tend to respond quickly and effectively with few exceptions. While some of these agencies are well known, others are not. They are listed in Table 5, together with the emergency tasks that they might be expected to perform during emergencies.

Table 5.--Names and Functions of Agencies Involved with Public Safety in Emergencies

AGENCIES	FUNCTIONS
Local	
Police Department	<ul style="list-style-type: none"> <li>- Guards facilities.</li> <li>- Controls traffic.</li> <li>- Prevents crime.</li> <li>- Controls crowds.</li> <li>- Controls access to operations areas.</li> </ul>
Fire Department	<ul style="list-style-type: none"> <li>- Fights fires.</li> <li>- Searches for and rescues the trapped, the wounded, and the lost.</li> <li>- Delivers first aid.</li> <li>- Provides for radiation monitoring and decontamination.</li> </ul>
Sheriff	<ul style="list-style-type: none"> <li>- Helps police maintain law and order.</li> <li>- Cares for prisoners.</li> </ul>

Table 5.--(Continued)

State	
National Guard	<ul style="list-style-type: none"> <li>- Helps local authorities protect life and property.</li> <li>- Helps in communications, transportation, and rescue operations.</li> </ul>
Civil Air Patrol	<ul style="list-style-type: none"> <li>- Helps police and fire departments in search and rescue missions.</li> </ul>
Department of Forestry	<ul style="list-style-type: none"> <li>- Helps protect forest against fires.</li> <li>- May provide labor for clean-up and communication operations.</li> </ul>
Department of Fish and Game	<ul style="list-style-type: none"> <li>- May aid in search and rescue missions.</li> </ul>
Other Agencies	
State Department of Corrections Department of Youth Authority State Conservation Corps	<ul style="list-style-type: none"> <li>- May help in emergency operations such as fire fighting, and State search and rescue missions.</li> </ul>

## Chapter 7

## WATER

One of the most important survival requirements in time of disaster is an adequate water supply. Water is plentiful and readily available under normal conditions; however, it is possible that the normal water supply could be completely cut off or contaminated during a severe crisis. This chapter will discuss water storage, purification, and finding water sources.

Water Sources

All families should store a two-weeks' supply of water for each family member. Water is more essential to life than food, so do not overlook this most important need.

In moderate weather each person engaged in little physical activity requires at least one-half gallon of water per day for drinking and food preparation, or a total of 7 gallons for two weeks. Some of this need for water can be met by fruit juices and soft drinks.

If you want to have water available for bathing, brushing teeth, dishwashing, and other purposes, another 7 gallons of water per person for two weeks is recommended. This water should be of the same quality as the water you expect to use for drinking.

Some of your water requirements could be supplied by making use of the water in home hot-water tanks and toilet tanks. Know the location of your main incoming water valve so that you can shut off the inflow of possibly contaminated water.

To get water from your hot-water tank, open the drain at the bottom of the tank. With the water inlet valve turned off, you may need to let

air in the system by turning on a faucet somewhere nearby to get water to flow out.

Water stored for emergency use must be clean. Any water that has been tested and approved by health authorities would be safe to store. If there is any doubt about the safety or cleanliness of water that you intend to store, purify it before storage.

Store your water reserves in thoroughly washed, clean containers, preferably of heavy plastic with tight-fitting caps, or in glass jugs or bottles with screw tops. Metal containers tend to give water an unpleasant taste. You may want to buy 5-gallon containers of rigid plastic or glass for water storage. The plastic containers have the advantage of being shatterproof and lighter in weight than glass jugs.

Protect glass water containers against damage or shock. You may wish to use newspapers or packing material to separate the containers from coming in contact with each other to prevent breakage during earthquakes or other major earth shocks.

Clean water which is stored as recommended should remain palatable for an indefinite period. Check your stores every few weeks for leakage, cloudiness, undesirable appearance, and taste. If the water looks or tastes strange, simply replace it.

#### Water Purification

In some emergencies the normal water supply will become contaminated. If that happens, warnings may be given by health authorities. However, if you are at all uncertain about the purity of tap water, it would be wise to purify it before use.

Moreover, in the event that disaster drives you and your family from your home, you may find it necessary to rely on available water for



an indefinite period of time. If this happens, it is essential that you purify such water before use. All such water sources should be considered unsafe until purified.

Water that has been contaminated by radioactive material should not be used unless no alternative supply is available. Infants and children are more at risk from such water than are adults. The danger from water contaminated in this way is greatest immediately after fallout deposition. That is, before the radioactive particles have settled to the bottom. After all sediment has fallen to the bottom, the top portion of water can be used if purified. Water from covered wells and springs would be safe for use.

#### Purifying Water

Boiling. Boiling is the safest method of purifying questionable water sources. Boil vigorously for 1 to 3 minutes (at least one minute plus an additional minute for each thousand feet of altitude).

Chlorination. To purify water using this method, add 8 drops of liquid chlorine bleach per gallon; 16 drops if the water is cloudy. Stir. Let the mixture stand for about 30 minutes. After this time, the water should still have a distinct taste or smell of chlorine. If not, add another dose of the solution to the water and let stand another 15 minutes.

Purification tablets. Water-purification tablets that release chlorine or iodine can be used safely to purify unsafe water. They are inexpensive and can be bought at most sporting goods stores and some drugstores. Follow the directions on the package. Usually 1 tablet is sufficient for 1 quart of water; double the dosage if the water is cloudy.

Iodine. You can use ordinary household 2-percent tincture of iodine to purify small quantities of water. Add 2 to 3 drops of iodine per quart of clear water, doubling the dosage if the water is cloudy. For a gallon, add 12 drops for clear water, 24 drops for cloudy water. Stir thoroughly.

#### Other Water Sources

If you have stored a two weeks' supply of water you will be able to draw from it for your daily needs and perhaps completely avoid turning to other sources. On the other hand, the normal water supply may be unavailable for an even longer time; perhaps an indefinite period; and you may have to rely completely on natural resources for your water supply.

#### General Guidelines

1. If disaster forces you and your family to leave your home, take water with you. Have able-bodied members of your family carry water provisions in canteens, thermoses, and other containers, depending upon your particular circumstance and mode of travel. At least carry purification tablets, chlorine and bleach, matches, and other means of making outside water sources usable.
2. Begin looking for water as soon as you become aware that your normal supply is unavailable or unsafe. If you have been forced to leave your home, finding water should be uppermost in influencing your direction of travel.
3. Dehydration can be a serious threat even in cold temperatures. If you have clean water available, drink as much as you feel

you need. (Your body needs at least 2 quarts of water daily to maintain efficiency--a smaller intake can weaken and slow you down considerably.) If you delay drinking, you will only need to compensate by drinking more later on.

4. Drinking water of unknown quality is always risky.
5. Purify all water from outside sources before drinking, using one of the methods described previously. If water is cloudy, use the boiling method.
6. Rainwater collected in clean containers is generally safe to drink and use without purifying. Rainwater collected from a storm system which may have passed through radioactive fallout may be dangerous.
7. Do not use water which you suspect has been exposed to radioactive fallout if you can avoid doing so.  
[See SBB P+P-8, "Shelter Management Handbook," for instructions on how to purify irradiated water.]
8. Water from streams, rivers, and other moving bodies is generally more safe for drinking than water from still ponds and lakes. Warm spring water is more likely to be contaminated than cold spring water.
9. Do not drink urine or sea water--the salt content is too high.
10. Snow and ice can be used unless there is reason to believe it has radioactive particles in it. It would be best to purify the melted snow and ice as discussed above.

### Finding Water in the Country

1. Look for lush, green areas, tree and vegetation lines, and damp ground, for clues in locating streams, creeks, springs, lakes, and other water sources. The presence of water birds and animals should indicate a nearby body of water. Watch animals and birds, and look for their trails--these will often lead you to drinkable water.
2. If you are unable to locate a surface water source, stay calm--you may be able to tap the underground water supply. Access to the groundwater supply depends upon the type of soil in the area.

Rock. In rocky ground, look for springs and seepages. Limestone and lava are more likely to harbor springs than other types of rock. Limestones are soluble--ground water carves waterways and caverns in them. Look in these caverns for springs, being careful not to get lost.

Ground water may seep through the bubble holes present in most types of lava. Look for springs along the walls of valleys that cross the lava flow. Some flows have no bubbles, but do have pipelike joints--vertical cracks that form columns a foot or more thick and 20 or more feet in height. You may find water creeping out as seepage, or pouring out in springs at the foot of these joints.

You may find seepage where a dry canyon cuts through a layer of porous sandstone. Most common rocks, such as granite, contain water only in irregular cracks. Look over the hillsides and try to locate an area where the grass is

green and lush. Dig a trench at the base of this green zone and wait for water to seep into it.

Loose sediments. Water is more abundant and easier to find in loose sediments than in rocky areas. Hunt for springs along valley floors, along the sloping valley sides, and in the flat stretches of land above river valleys.

Don't waste time digging for water in an area unless you have good reason to believe you will find it. Digging out a lush area where a spring existed during the wet season may yield water.

Along coasts, you may find water in the dunes above the beach itself, well back from the high-tide line. Look in the hollows between sand dunes for visible water, or dig if the sand seems moist.

3. Ice and Snow. Ice and snow may be water sources, but fuel is needed to melt them. Always use available water sources before using fuel in short supply to melt snow or ice into drinking water.

Whenever possible, melt ice rather than snow for drinking purposes. Ice yields more water by volume more quickly, and with less heat. You may melt snow by heating it in a pot a little at a time, compressing as you add more--this will keep the pot from burning.

If the sun is shining, you may melt snow by placing it on a flat rock, dark material, or any surface that will absorb the sun's heat. Arrange the surface so that melt-water will drain into a hollow or container.

If fuel is plentiful, try to drink at least 2 quarts of hot tea or water daily instead of cold water or snow.

If you are short on fuel, you may melt snow in your bare hands, or mouth.

4. Desert. In hot deserts you need a minimum of one gallon of water per day. By walking in the cool desert night, you can get about 20 miles on that daily gallon. However walking in the heat of the day can cut your mileage in half.

The only way to conserve water is to control your sweating. Drink water only as you need it, and keep heat out of your body by keeping your clothes on. Clothing helps control sweating by not letting perspiration evaporate so fast that you get only part of its cooling effect.

When looking for water along sandy beaches of desert lakes, dig a hole in the first depression behind the first sand dune. Stop digging when you hit wet sand. This first water is fresh or nearly so, and drinkable. If you dig deeper, you may strike saltwater.

In stony desert country, look for dry stream beds. Dig at the lowest point on the outside of a bend in the stream channel.

In mud flats, during winter, you may find wet mud at the lowest point. Wring out mud in a piece of cloth to get water, but don't drink it if it is very salty or soapy tasting.

5. Tropical areas. Water from tropical streams, pools, and swamps is safe to drink only after purification. Such water

may be partially cleared of debris by using a cloth as an improvised filter.

You can get nearly clear water from muddy tropical lakes or streams by digging a hole in sandy soil 1 to 6 feet from the bank. Allow water to seep in, and then wait for the mud to settle.

## Part II

## Common Emergencies

## INTRODUCTION

It is a truism that those people who take adequate steps to prevent threats to themselves from disasters are much less likely to be seriously affected by them. Monsoons in India, Thailand, and Viet Nam cause many deaths by drowning each year. But generally these deaths occur among those who are not prepared to adequately deal with the monsoons. Floods in Arizona tend to occur in the same places, and, with rare exceptions, affect only those people who build homes in likely spots for flooding. Apartment fires generally take lives in places where appropriate preventive steps have not been taken. Automobile accidents tend to occur far more often among people with certain driving practices.

In this section of the handbook those emergencies will be discussed which occur often and are most likely to affect large numbers of people. Guidance will be given as to the nature of those emergencies, how to prepare for and avoid them, and how to deal with them should they occur.



## Chapter 8

## BOMB THREATS

During the past 10 years, there has been a startling increase in the number of incidents involving bombs used for malicious purposes in the United States. These incidents average about three a day, and the rate is increasing. Throughout the entire world the use of bombs for terrorist purposes has grown as well. Within the space of a few week's time in 1981, for example, the Iraqi embassy was destroyed by bombs in Beirut, Lebanon; and a group of children were killed while playing on the beach waiting for Santa Claus to appear at their party. Terrorists were responsible.

The purposes of terrorist activity involving bomb threats are to generate anxiety among the public, attempt to convince citizens that their government is powerless to prevent acts of seemingly random terrorism, and to get immediate and inexpensive publicity for their causes.

Not all bomb threats are terrorist inspired, however. Many are acts of simple revenge--especially those directed at private persons. Some are acts of intimidation by criminals who fail to achieve their objectives otherwise. And some are coercive acts designed to get money from others using bomb threats. The explosion that occurred at a Lake Tahoe resort in 1981 is an example. In this instance, warning was given to the hotel and its guests that unless money was delivered according to instructions, the hotel would be blown up. Despite an intensive search for the bomb, it was not found in time to prevent the hotel from severe damage due to the subsequent explosion.

### Targets

Most bomb threats occur in large public facilities such as airports, train stations, schools, and other public buildings. Most people in such public places from time to time might be targets. Less often bombing targets will be commercial establishments, and even less often they will be individual residences or vehicles--except where the latter are used by high government officials or political leaders.

### Warnings

Fortunately for the general public, most bombings occur after a warning has been given. At the same time, 95 percent of bomb threats are false in nature. It is very unlikely, therefore, that steps taken to clear people of buildings or other facilities where warnings have occurred about bombs will actually be followed by detonations. It is very prudent, nevertheless, to follow instructions given to prevent possible injury and loss of life.

When such warnings are given, the following steps should be taken:

1. Take calm, but decisive action to leave the threatened place, carrying with you only minimal personal belongings.
2. Follow directions given by those in charge.
3. Once away from the threatened area--stay away. Do not return for belongings. If you have very good reason to believe that friends, relatives or other persons remain in the threatened place for some reason or another, do not try to get them yourself. Notify a police officer or others in charge, giving simple but complete information. Leave subsequent actions up to them.
4. Treat any unidentified package as a bomb. Do not move it. Notify authorities immediately.

If you are in a position to receive bomb threats, there are some procedures which you ought to make sure you follow in order to reduce the risks for yourself and others. These are:

1. Keep as calm as possible so as not to endanger yourself and others.
2. Note the exact time the warning was received and when the warning ended.
3. Record the exact words of the caller. If possible, ask the caller to repeat the warning so that you can be sure of what is said.
4. If possible, ask the caller the following questions on forms like that shown below, so that sufficient information is available to help protect innocent people.
  - a. What time is the bomb set to explode? \_\_\_\_\_
  - b. Where is the bomb located? Area? Floor? \_\_\_\_\_
  - c. What kind of bomb is it? \_\_\_\_\_
  - d. What does the bomb look like? \_\_\_\_\_
  - e. Why do you want to kill or injure innocent people? \_\_\_\_\_

If it is possible at this point to keep the person engaged and give a message to others to notify police of the threat, it would be very helpful.

5. Report the warning yourself to the police or security officials responsible for such incidents.
6. Write down what you can about the characteristics of the person giving the warning:
  - a. Sex: ☐ ....Male ☐ ....Female ("X" one)
  - b. Emotional Condition: ☐ ....Very upset ☐ ....Nervous  
☐ ....Calm
  - c. Age: ☐ ....Child ☐ ....Teenager ☐ ....Young adult  
☐ ....Middle aged ☐ ....Old
  - d. Speech:
 

Accent \_\_\_\_\_

(Write down where you think the person was raised--South, West, Midwest, Northeast, or better, the state)

Unusual words or phrases used \_\_\_\_\_

7. Give all the above information acquired to the police or other security authorities quickly. If a note were delivered, rather than a telephone call, give the note to authorities. If a threat is made in person, prepare to give the authorities such information as the height and weight of the person, clothing worn, and mode of transportation. If a vehicle were used, try to remember its license plate number, the model, and color.

### Types of Bombs

There are two basic types of "bombs" which might be used to threaten or actually hurt or kill people, or destroy property. The first of these is an "explosive" device, whereas, the second is an "incendiary" device. The first is designed to blow up and inflict damage by the force of the blast. The second is designed to catch surrounding materials on fire causing damage, injury, or loss of life through fire.

### Explosive Devices

There are a great many different types of explosive devices that are used by bombers--so many, in fact, that the untrained person cannot ordinarily tell whether they are dealing with a bomb or not. Unless instructed by trained authorities, no search should be made for bombs by untrained persons. Such searches should be undertaken by trained persons only. Under no circumstances should suspected bombs be moved or even touched by untrained people. Some bombs are made so that they will detonate if only slightly moved or jarred. The location of any suspected bomb should be given to authorities immediately.

If bomb threats have occurred, almost all objects that have not previously been in a place might contain, or be, a bomb. These would include suitcases, briefcases, packages, heavy letters or envelopes, or more obvious devices. The latter would include large metal or plastic

pipes with enclosed ends and either fuses or timing devices attached to them. None of these devices have to "tick" in order to be a "time bomb."

#### Incendiary Devices

There are many ways of starting fires in buildings, vehicles, or other places which will ignite after the fire-starter has had time to leave. These include bottles or cans with burning wicks left in them, candles, or even cigarettes or cigars. If such burning materials are obvious, they may be extinguished carefully, and authorities notified. However, if fuses are connected to them and are burning, they should not be picked up, but only extinguished if possible. If the materials are such that they cannot be extinguished using ordinary means, authorities should be notified so that special procedures and materials can be used.

In summary, basic procedures to follow in the event of a bomb threat are:

1. Leave the area using designated routes according to officials' instructions.
2. If you are the person notified of the threat, inform officials immediately, giving them full information about the threat and as much as you can about the person making the threat.
3. In a bomb threat situation, notify officials of any unusual objects or materials, extinguishing--if possible--inflammatory materials, but not attempting to move anything unless acting upon the instructions of trained personnel.

## Chapter 9

## CHEMICAL ACCIDENTS

With the increasing use of chemicals in today's households and industry, the danger of chemical accidents is increasing. Many common chemicals have harmful and dangerous effects when misused. Flammable and combustible chemicals may explode or ignite instantaneously, causing death, serious injury, and damage to buildings, homes, and property. Exposure to some toxic chemicals may bring death or serious, long-lasting physical ailments.

In recent years, for example, a huge cloud of Dioxin was released in an explosion at a chemical plant in Meda, Italy. This deadly chemical apparently damages the kidney, liver, and lungs, and may cause birth defects. The explosion necessitated the relatively permanent evacuation of some 700 people from their homes.

Another, almost common, accident occurred in Cleveland, Ohio in a storage area for liquid gas. Flames were sent throughout a 50-block area and killed 125. More than 200 others were injured, and damage was estimated at \$10 million.

Most major chemical accidents occur in plants and other areas where large amounts of chemicals are in frequent use. Many others result from traffic accidents involving the transportation of chemicals. As a protection to travelers, the U.S. Department of Transportation requires that these vehicles be labelled with identification and warnings. However, most victims of chemical accidents are injured at home. Usually these accidents result from ignorance or carelessness in using flammable or combustible materials.

Chemical accidents in your own home may be prevented by taking the following precautions:

1. Recognize that flammable liquids are extremely dangerous, and should be used only in certain ways:
  - a. store all liquids such as gasoline, acetone, benzene, lacquer thinner, etc., in tightly-capped metal cans, and away from a dwelling. Store quantities of one gallon or less. If such materials must be stored inside your home, use a storage can which bears the UL or FM approval label.
  - b. remember that such liquids can discharge invisible explosive fumes. If used inside, be sure the area is well-ventilated. Keep these fluids away from heat sources and open flames.
  - c. never use gasoline or similar liquids to start or "freshen" a fire. If you must "freshen" your charcoal fire, moisten a few pieces of charcoal separately with lighter fluid, then carefully add them separately to the grill.
  - d. avoid buying liquids labelled "extremely flammable." In any case, purchase only the amount you need. Once opened, store in a well-ventilated area in the original container. (People & Fire, U.S. Department of Housing & Development p. 15.)
2. Combustible liquids such as paint thinner, kerosene, charcoal lighter fluid, turpentine, etc., are flammable when heated, when in a spray, or when spread in a thin layer over a large surface. Keep all such fluids away from heat.
3. Be sure to store all toxic chemicals out of reach of children (p. 15).
4. Always wash thoroughly after exposure to strong chemicals, and change your clothes and allow them to dry in a well-ventilated, cool area, if you have spilled on them.

5. The principal threats of chemical exposure are inhalation, skin exposure, swallowing, and eye exposure. Make sure you are familiar with the first aid measures for each.

#### Procedures

If you become involved in any type of chemical accident--at home, on the road, or in your community--follow these suggested procedures:

1. If a fire or explosion occurs in your own home, get out immediately and call the fire department--do not try to fight the fire yourself.
2. In the case of a major chemical accident:
  - a. stay out of the area. You can hinder operations and risk your life by being at the scene of a major accident.
  - b. if you are in or near the area, don't panic. Follow the directions of those in charge.
  - c. during any such crisis, check out suspected rumors with official sources. Radio and TV broadcast will provide valid information.
  - d. if you are near the scene of a chemical accident, leave instantly to avoid inhaling toxic fumes. Wash any chemicals off your skin immediately, and throw out contaminated clothing.
  - e. do not attempt to rescue someone who has been overcome by fumes without the proper respiratory equipment.



## Chapter 10

## EARTHQUAKES

Current theories describe the earth's crust as being made up of "plates" which are constantly shifting. Where these plates meet, pressure often builds up until movements occur. These movements we call "earthquakes." They are often sudden and release tremendous amounts of energy. This energy travels in waves outward in all directions sometimes causing damage.

Earthquakes may trigger landslides, tsunamis (huge, seismic sea waves) fire, and the failure of dams and levies. Lives are sometimes lost because of falling objects, flying glass, overturned furniture, and the collapse of buildings and even mountains. The dangers can be even further increased by human reactions.

Many earth scientists in this country and abroad are trying to find means of predicting impending earthquakes, but as yet, accurate predictions cannot be made. From past experience, however, it can be assumed that earthquakes will continue to threaten humankind, and that they will occur most frequently in the areas where they have occurred in the past.

In the United States, earthquakes can be expected in the Western States, particularly in Alaska, California, Washington, Oregon, Nevada, Utah, Hawaii and Montana. The danger, however, is not totally confined to any one part of the country. Major earthquakes have occurred in other states, such as the New Madrid, Missouri (1811-12) and Charleston, S.C. (1886) earthquakes. Both were felt over two million square miles.



About 50,000 earthquakes occur on the earth each year, many of them of such intensity as to cause severe loss of property and even life. (U.S. Army photograph of earthquake in Southern Japan, 1948)

The Richter Magnitude Scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to measure the size of an earthquake. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude of 5.3 might be computed for a "moderate" earthquake, and a "strong" earthquake might be rated as magnitude 6.3. Earthquakes with magnitude of about 2.0 or less are usually called "microearthquakes"--they are not commonly felt by people and are generally recorded only on local seismographs. Events with magnitudes of about 4.5 or greater--there are several thousand such shocks annually --are strong enough to be recorded by sensitive seismographs all over the world. "Great" earthquakes, such as the 1906 San Francisco earthquake and the 1964 Good Friday earthquake in Alaska, have magnitudes of 8.0 or higher. On the average, one such earthquake occurs somewhere in the world each year. Although the Richter Scale has no limit, the largest known shocks have had magnitudes in the 8.8 to 8.9 range.

#### Preparation

To be prepared for an earthquake to strike, persons should have fastened or tied down water heaters and gas appliances. Once an earthquake has happened, gas, water, and electricity should be turned off until the threat has passed. Earthquake hazards should be discussed with your family as part of the Family Emergency Plan to reduce possible fear and teach correct reactions. An emergency two-week supply of water and canned foods should be stored together with a portable stove, matches, eating utensils, a can opener, first aid, and other essentials. Also, storing a battery-operated radio and flashlight with extra

batteries, a fire extinguisher, emergency telephone numbers, and blankets or sleeping bags would be prudent.

### Procedures

If you are the victim of an earthquake, try to stay calm. If you are inside, stand in a doorway or corner, or crouch under a heavy table or desk. Stay away from windows, mirrors, and chimneys. Do not run outside.

If you are outside when the quake occurs, get away from buildings, trees, and utility lines. If you are in your car, drive away from any underpasses or overpasses, stop your car, and stay in it.

After an earthquake:

1. Check for injuries--provide first aid if needed.
2. Check for fires.
3. Check for structural damages to your home--roof, foundation, chimney, etc.
4. Check utility lines and appliances for damage.
5. Listen to radio for further information.
6. Don't re-enter damaged buildings.
7. Make sure sewage lines are intact before flushing toilet.
8. Check gas lines for leaks and watch for electrical short circuits.
9. Don't use telephone except in case of real emergency.
10. Be prepared for "aftershocks."
11. Keep emergency supplies together and ready in case of evacuation.
12. If power is off, use perishable foods from freezer first.

For further aid in recovery, contact the American Red Cross, the Salvation Army, and local government and disaster relief services.

For further information on earthquakes, please refer to Appendix C.

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EMERGENCY PREPAREDNESS: A HANDBOOK FOR FAMILIES.(U)  
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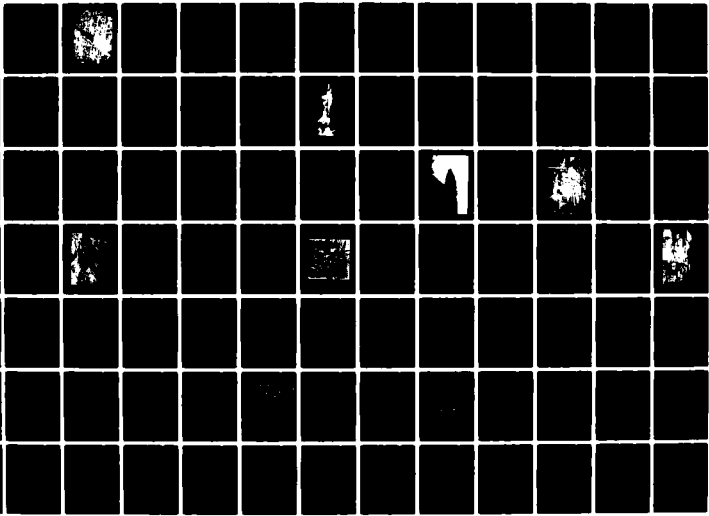
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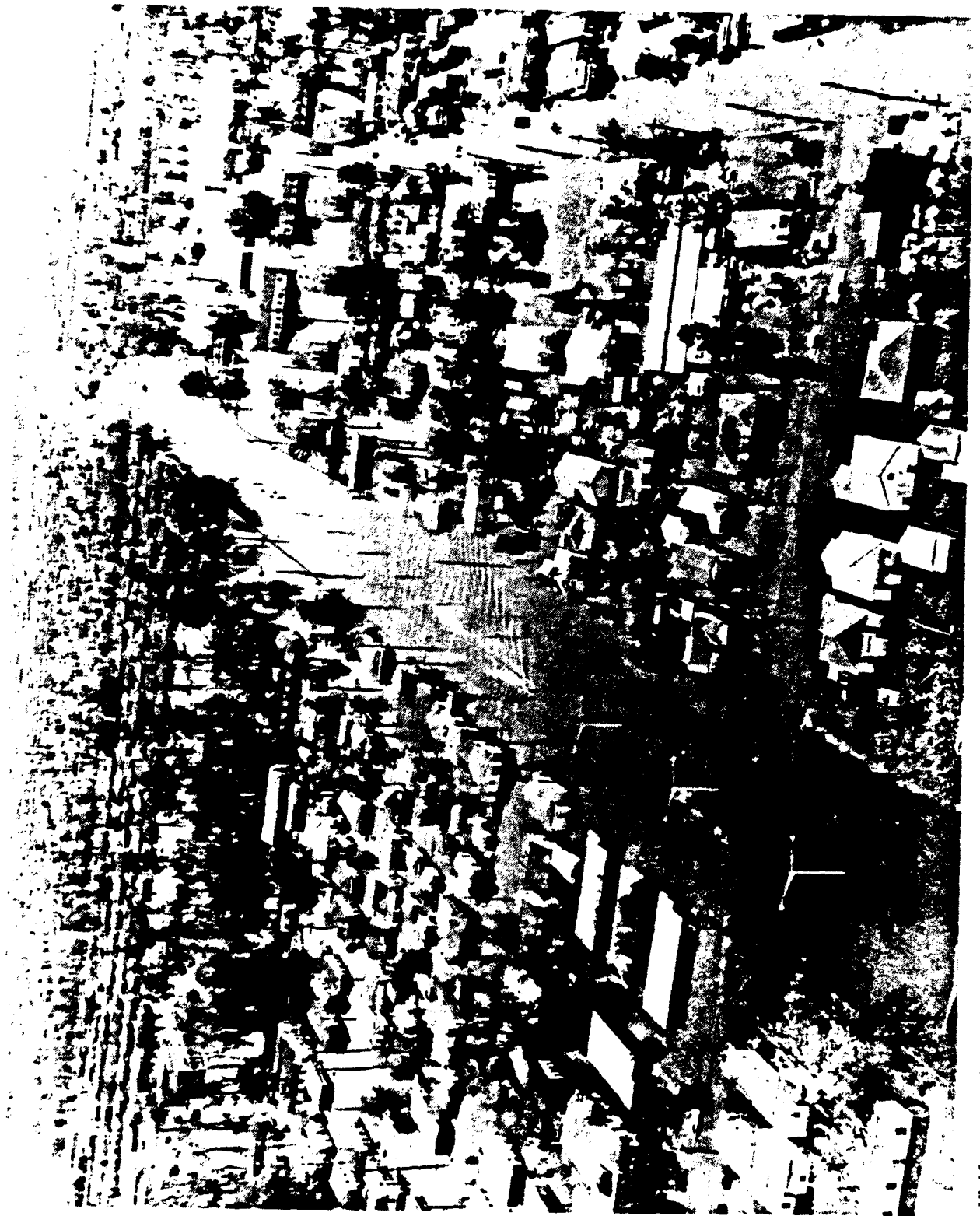
## Chapter 11

## FLOODS

A flood is an overflow of water which covers normally dry land. Floods are caused by abnormally heavy rainfall, heavy snow runoff in mountainous areas, landslide and volcanic events, dam failures, hurricanes, and tsunamis. The primary threat from flooding is the destructive force of the water's current. Such damage may include disruption or destruction of communication, power, and electrical systems; damage to highways, bridges, homes, property, and crops; and of course, the worst threat of all, drowning of people and animals.

The flood resulting from the collapse of the Teton Dam in Idaho in 1976 killed eleven people, for example, and cost millions of dollars in property damage. Johnston, Pennsylvania, is the site of some of the most infamous floods in American history. The most recent of these floods occurred in July of 1977. Nearly nine inches of rain fell during an eight-hour period. Seventy-seven people were killed, 500 homes destroyed, and another 2,000 damaged. The overall cost of damages was over 200 million dollars.

Floods occur in almost every part of the United States, where an estimated 50 million acres are subject to flooding. In certain areas, flood threats occur at predictable times each year. In mountainous and desert regions, however, flash floods can strike with little or no warning. Usually caused by heavy rainfall, dam failure, earthquake, or ice-jam breakup, these deadly sudden floods can move at incredible speeds, and can wipe out entire communities.



While periodic flooding can be beneficial to agriculture, uncontrolled flooding usually results in loss of property, mobility, and utilities at best. At worst, hundreds of thousands of fatalities may occur. (U.S. Army photograph of flooding in New Orleans that occurred following Hurricane Betsy, 1965)



### Warning

You should be aware of past floods in your area, and the potential of flooding in the future. It is a good idea to find out whether your property is above or below possible flood levels, so that prior decisions may be made. For protecting people and property, it makes sense to be very aware of local flood warnings given via television, radio, or through local siren or bell systems.

A flood warning indicates that flooding is expected to occur in a certain area. You will be informed by radio and TV of expected severity, location, and time of flooding. A flash flood means that heavy rains are occurring, or are expected to occur, which may soon cause flash flooding in certain areas. With this warning, appropriate protective actions ought to be available. A flash flood warning indicates that flash flooding is occurring or is imminent on certain streams or designated areas--immediate action should be taken for protection if you are in the affected area.

### Preparation

Prior planning should be done in order to be prepared when a flood does occur.

1. Be aware of flood-producing conditions in your area, and watch for them.
2. Locate the nearest safe area you can flee to in case of a flood--be prepared to evacuate.
3. Know how to turn off power, gas valves, and water service.
4. Store food that requires little cooking and no refrigeration, water, and medical provisions.
5. Move valuable items to upper floors of your home.
6. Make sure that flashlights and battery-operated radios are in working order--have extra batteries on hand.

7. Board up windows.
8. Remove any insecticides from dwellings to prevent contamination.
9. Store medicine and chemicals where floodwaters can't reach them.
10. Disconnect eave troughs if connected to house sewer.
11. Remove toilet bowl. Plug basement sewer drains and toilet connections.

### Procedures

During an actual flood:

1. Stay on high ground.
2. Do not attempt to cross a flowing stream if the water is above your knees.

In case of evacuation:

1. Check to see how much gas you have in your car.
2. Leave early--don't wait until the last minute.
3. Take warm clothing and blankets, flashlight with batteries, radio, personal documents and identification, emergency supplies, and food and water provisions.
4. If your car stalls, abandon it immediately and walk to higher ground. Many people drown while trying to save their cars.
5. Follow only recommended routes.
6. Do not attempt to drive over a flooded road. You may become stranded and trapped.

Once the immediate danger from the flood is over, you should stay tuned to television and radio stations for instructions in obtaining food, housing, medical aid, etc.

1. Don't visit disaster areas--your sightseeing will only interfere with rescue and clean-up attempts.
2. Report broken utility lines.
3. Do not use lanterns or torches in damaged buildings.

4. Purify all water before drinking.
5. Do not eat food contaminated by flood waters.
6. Do not use appliances or equipment until they have been cleaned, dried, and checked for damage.

Sources of Help:

Red Cross, local government agencies.

## Chapter 12

## FOREST FIRES

More than 600,000 destructive forest, brush, and grass fires occur in the less-populated areas of the United States each year. In addition to destroying lives, buildings, wildlife, and other valuable natural resources, these fires often adversely alter ecological and agricultural systems of the affected areas.

Precipitation, humidity, winds, and temperature are major factors related to fires starting and spreading. Forest fires are most likely to occur during hot, dry periods.

While many forest fires in the U.S. are caused by lightning, man is responsible for causing a large proportion of our forest fires. Origins of these man-caused fires are, in order of relative frequency: incendiarism, debris burning, smoking, lightning, machines, and campfires. Three out of every 10 fires in the United States during the past five years were traced to incendiaries. They burned an average of about 1,000 square miles a year. Almost as serious are debris-burning fires which burn out of control into adjoining woods. These fires burn about 500 square miles a year in the U.S. Incendiarism and debris-burning together account for over half the annual burned area in the Northeast, over two-thirds in the Midwest, and three-quarters in the South. Smokers are also a major cause of wildfires--around 250 square miles a year. Each of these causes involves either ignorance, failure to take proper precautions, stubbornness, maliciousness, or carelessness.

Forest fires often cause tremendous damage, and are extremely dangerous and difficult to control because of their intense heat, speed,

and size. Devastating wildlife areas, burning acres of timber, and blackening miles of countryside, they interrupt recreational activities and destroy homes, businesses, and crops.

For instance, two million acres of woodland were destroyed in Kentucky and West Virginia during October of 1952 by forest fires.

And during a particularly dry year in 1966, the entire Pacific Northwest experienced drastic increases in forest fires. In less than six months, 325 fires were reported which destroyed over 300,000 acres of timber.

The National Forest Service recently modified its policy of fighting all forest fires. Some fires are now allowed to "burn themselves out," clearing heavy timber stands of dense undergrowth, and ridding areas of diseased vegetation. Such fires are considered to be encouraging new growth and rejuvenation of forest areas.

Although forest fires are often the result of natural causes, most start through man's carelessness. Therefore fire prevention is a good practice for most. It should be recognized that spark-arresting and other devices should be installed on machinery used. It seems obvious that care with smoking materials and matches has to be used in wildland areas. Before leaving a campsite, it is wise to thoroughly extinguish campfires. When burning garbage and debris, materials should be on hand to extinguish a fire if one were to get out of control. An area where a fire is burning should not be left before the fire is completely out.

If you live in the eastern United States, fire is most likely to break out during the fall and spring; however, severe weather can extend this period. In western regions, the dryer summer months are especially dangerous.

### Warnings

U.S. and state foresters systematically scan their areas for fire and fire hazards. Notices of fire danger are frequently posted, put in newspapers, and shown on TV. If a blaze is detected in your locality, warnings will be issued through radio, TV and other means.

If you sight a fire, immediately report it by phone to your local fire department, fire warden, sheriff's office, or U.S. Department of Agriculture's Forest Service.

### Procedures

If a forest fire becomes a threat to your area, there are several things you should do:

1. Be aware of weather and wind conditions. Post a lookout.
2. Extinguish any fires in your home and on your property--campfires, burning trash, etc.
3. Locate and secure stock and children.
4. Stay tuned to television and radio broadcasts--always know where the fire is.
5. Clear your property of brush, litter, and flammable vegetation up to thirty feet around your home and buildings.
6. Ready yourself and family with water supplies--hook up hoses, etc.
7. Close and cover all windows.
8. If an evacuation is ordered, act promptly--fires can move at unbelievable speeds. Use designated escape routes.
9. Once your home is secured, assist in community fire-fighting if you are able.

Hints for personal survival if you are trapped in a forest fire:

1. Do not try to outrun the fire--it can't be done.
2. Look for a nearby body of water; crouch down in the water and use wet clothing to cover your head.
3. If no water is available, lie down flat on the ground, cover your body with wet material, soil, or reflective material.
4. If possible, breath through a wet cloth.
5. Heavy exertion increases oxygen demand, so try to remain calm.  
Breathe the air close to the ground.

For aid in recovery, you may turn to the U.S. Forest Service, your state forest service, the American Red Cross, Salvation Army, and government agencies.

## Chapter 13

## HEAT WAVES

Heat waves are periods of extremely high temperatures which usually occur during the summer. These periods are generally accompanied by excessive humidity in the eastern United States and dryness in the West.

About 200 Americans die each year from excessive heat. Young children, the elderly, and those who are sick or overweight are the most common victims. Men are more susceptible to heat illness than are women, because of their tendency to sweat more.

During a heat wave, much more energy than usual must be expended to maintain normal body temperature and to perform daily activities. High temperatures and humidity cause the body to lose large amounts of salt through increased perspiration. In this depleted condition, the body can quickly become dehydrated and overheated. This may lead to various complications, such as heat cramps, heat exhaustion, heat stroke, and even death.

Examples

In June of 1962, seventeen eastern states reported heat wave conditions. High temperatures persisted for five days, killing 160 people.

Severe heat waves occur at a rate of about once a year in the U.S.

Preparation

Prepare yourself for the stresses of a heat wave by having a complete physical examination. Your doctor will be able to inform you of your general physical health and tell you how you can endure best.



If you are in a run-down condition, he may prescribe medication, diet, exercise, etc., to assist you in improving your fitness.

During a heat wave you will probably be spending more time indoors. Your home should be a comfortable refuge from the heat. Your air conditioning ought to be working well. You can prepare for a power outage, however, by purchasing hand fans, sunshades, double windows, and better insulation. If necessary, be ready to move to the countryside.

#### Procedures

1. During a heat wave, stay indoors as much as possible.
2. Do not place any additional stress on yourself by neglecting your physical health. Get plenty of rest and eat well-balanced meals.
3. Slow your normal pace of activity--your body loses energy more quickly in the intense heat.
4. Dress appropriately in light colors, cottons, etc.
5. Drink plenty of water.
6. Avoid sunburn--your body will have to work harder to stay cool.
7. Be prepared to identify and treat the following:

#### Heat Cramps

Victim will experience muscular spasms and pain, usually in the legs or abdominal region, caused by loss of salt. Give one-half glass of saltwater (one teaspoon of salt to one glass of water) in small amounts every 15 minutes for one hour.

Heat Exhaustion

Symptoms include headache, dizziness, nausea, excessive sweating and pale and clammy skin. Body temperature will be close to normal. Have the victim lie down in a cool room with feet elevated. Loosen tight clothing. Apply cool, wet cloths and administer saltwater as directed above.

Heat Stroke

Immediate action is critical in helping a victim of heat stroke. Call for emergency help first, then give first aid. Heat stroke usually results from overexposure to direct sunlight. A heat stroke victim will have an extremely high body temperature. His skin is hot, red, and dry, and he will not sweat. Cool the victim by placing him in a cool tub of water, applying cold packs or sponging him off with cool water. Continue the process until emergency help arrives.

## Chapter 14

## BUILDING FIRES

The United States suffers more death and damage from fire than any other technologically-advanced country in the world. More than one million structural fires occur each year in the U. S. Over 12,000 lives are claimed annually by such fires, with property losses totaling more than five billion dollars.

An apartment house fire in Chicago interrupted a Christmas party in December of 1976, killing eight small children and four others. It is believed that the fire was started when someone spilled a pan of flaming grease onto the wooden steps. Several thousand people had gathered for dining and entertainment at the Beverly Hills Supper Club in Southgate, Kentucky, one spring evening in 1977. A kitchen fire spread fire and smoke quickly throughout the building causing the roof to cave in and killing 162 patrons.

It is a common misconception that most fire victims "burn to death." The usual cause of death is asphyxiation from toxic gases and smoke inhalation. Most fire victims never see the flames.

The majority of fire deaths occur in single-building fires. Household fires are usually the result of carelessness. Studies have shown the most common causes of residential and single building fires involve: (1) cooking, (2) smoking, (3) heating, (4) incendiary or suspicious causes, (5) electrical distribution, (6) appliances, (7) children playing, and (8) carelessness with an open flame. Most of these can be prevented.



More than one million building fires occur in the United States each year resulting in the loss of more than 12,000 lives. (U.S. Army photograph of fire in the 55th QM Depot, Pusan, Korea, 1954).

By practicing the basic fire safety habits shown below, and by taking a few precautions, you can significantly reduce the chances of fire loss in your own home.

1. Have family members sleep with doors closed. This slows the spreading if flames should break out.
2. Use inflammable sleepwear for children.
3. Store matches out of children's reach.
4. Use large, non-combustible ash trays in each room of your home.
5. Never smoke in bed.
6. Keep your yard and home area clear of debris, particularly if you are burning trash, cooking outdoors, etc.
7. Use only 15 amp. fuses for household lighting circuits.
8. Don't overload outlets.
9. Keep storage areas organized and clear of litter.
10. Use only electrical equipment labeled by the Underwriter's Laboratories (UL).
11. Do not store flammable liquids in breakable containers, and keep them away from heat sources.
12. Have heating equipment checked regularly.
13. Use screens on all fireplaces.
14. Allow air space around television and stereo to prevent overheating.
15. Never "freshen" a fire by using a flammable liquid. If you are cooking on a charcoal grill, moisten briquets individually and add them to your fire.
16. Avoid cooking in loose clothing.

You can also protect your family by installing a smoke detector in various places in the house. Many unsuspecting fire victims have died simply because they slept right through a fire until overcome by smoke.

Every family should be protected by a home fire alarm system. Home fire alarm systems vary considerably in complexity and cost. They may range in price from \$30 to \$1500. The single most important component of any home fire alarm system is a smoke detector. This device senses abnormal amounts of smoke or invisible combustion gases in the air, thus it can detect smoldering and burning fires. Smoke detectors can be either house-current or battery operated. Either type is adequate. Be sure your smoke detector is labeled by the Underwriter's Laboratories

(UL) or Factory Mutual (FM). The more units you install in your home, the safer you will be in the event of a fire.

Prepare your family to cope with an actual fire. In a real situation, fire sometimes spreads so rapidly that you may have only a few minutes to get to safety. All family members must know where to go and what to do. Draw a floor plan of your home on graph paper as shown in Chapter I. Mark two escape routes from each room of the house, and have family members memorize them. Emphasize the importance of getting out quickly. Have a practice drill. Be especially sure that children can use the escape routes. For example, they must be able to open windows and door locks. Agree on a meeting place where all can gather after "escaping." Try to make the drills as realistic as possible. The more prepared you are for a fire, the less likely that family members (especially children) will panic in a real situation and be lost.

#### Procedures

In a fire emergency, there is no time for doubt or indecision. Nothing should come before getting everybody out of the burning home. It's natural to want to protect your property, but first make sure all the people are alerted and evacuated.

The first few minutes are critical. A fire can spread much more rapidly than you'd think. Even a small delay--while deciding whether the fire is serious or not, or trying to fight the fire yourself, or even calling the fire department--can be tragic. People should be evacuated before anything is done.

If you smell smoke, see flames, or hear the sound of fire, first alert everyone in the home. Scream and shout. Help those who cannot

help themselves. Get everyone on the second floor out of the house as fast as possible.

If the bedroom door is closed, test before opening it. If smoke is pouring in around the bottom or if it feels hot along the top edges, it is already too late to escape through the hallway and down the stairs. Keep your door closed. Use a window for escape or to get fresh air while awaiting rescue. If you do not see smoke and the upper edge of the door is not hot to touch, open the door slowly but be prepared to close it again quickly. If the hallway is passable, act fast. Close doors behind you to slow down the spread of the fire. If you live in an apartment building, don't use the elevators. You might get trapped.

In leaving the house, remember that hot gases and smoke collect near the ceiling first, then move toward the floor. If you keep low you have the best chance of getting out of smoke-filled rooms and hallways.

If the basement or ground floors of second-story houses have fires, windows may be the only means of emergency escape. Second floor window sills are usually not more than 13 feet from the ground. An average person, hanging by the fingertips, will have a drop of only about six feet to the ground. Often, the second floor window opens onto a porch roof or balcony from which it's possible to drop to the ground or await rescue.

If you live in an apartment building, escape through windows is possible only from lower floors. If the fire is in your apartment, first get everyone out. Close the door behind you and alert others in the building. Use the nearest "pull box" if possible. Use stairways or fire escapes rather than elevators.

Most high rises are built of materials which will not burn and will not collapse even if a severe fire occurs. A fire in such a building will normally be confined to the apartment where it started, provided the apartment door is closed. In most cases, if the fire is not in your apartment, you could stay there in complete safety. The only time you should think about getting out is if smoke is beginning to fill your apartment and the corridor is still clear of smoke. If the corridor is smoke-filled and you can't reach a stairway, close all the doors between you and the fire. Vents through which the smoke could reach you should be closed or blocked. Open a window (break one if necessary). You must have fresh air. Call the fire department from your apartment.

After the fire:

1. If you are in need of food, housing, clothing, etc., contact the Salvation Army or the American Red Cross.
2. Secure your home from theft and weather damage. The fire department will aid in this.
3. Contact your insurance agent.
4. Obtain any medical treatment necessary.
5. Be cautious in returning to your home. Watch for smoldering remains. Be sure all wiring and utilities are safe before using them. Do not use food that has been exposed to heat, smoke, or soot. Be watchful for structural damage to roofs, floors, etc.
6. Save receipts for any money you spend relating to your fire loss.
7. Do not discard damaged goods until after inventory has been taken.
8. Consult your insurance agent before contracting for estimating, inventorying, or repair services.

Special assistance may be obtained by contacting your local fire department, insurance agent, Salvation Army, the American Red Cross, or other disaster relief services in your area.



## Chapter 15

## HURRICANES

Hurricanes are tropical storms in which winds reach speeds of 74 miles per hour or more. These winds blow in a large spiral around a relatively calm center called the "eye." Every year hurricanes bring destruction to coastlines and islands. Since 1978, the most dangerous of these storms have been named by using the letters of the alphabet, beginning with the letter A and alternating with male and female names. About eight to ten such storms per year are large enough to be named by the United States Weather Service.

While hurricane winds do the most damage, high water and resulting drowning is the greatest cause of hurricane deaths. As these storms approach and move across coastlines, they bring huge waves and tides which raises water levels to 25 feet or more above normal. Worse, the rise in water levels sometimes comes rapidly. Waves and currents likewise erode beaches and barrier islands, undermining waterfront structures, and washing out highway and railroad beds. Torrential rains that accompany hurricanes produce sudden flooding as the storm moves inland. After winds begin to diminish, floods constitute the hurricane's greatest threat. The collapse of buildings and downed utility lines are also threats.

Most hurricanes affecting the United States strike the eastern coastal states, and occur in August, September, and October. The six-month period from June 1 to November 30 is considered to be the Atlantic hurricane season. Some Pacific hurricanes (usually weaker than their Atlantic counterparts) strike Southern California also, and bring torrential rains to the southwest United States.



Hurricanes can cause substantial property loss as well as fatalities owing to their awesome power and associated hazards. (U.S. Coast Guard Photo from the American Red Cross of hurricane along Miami Beach, Florida in 1947).

The most costly natural disaster in U. S. history was hurricane "Agnes," which struck the mid-Atlantic States in June of 1972. Agnes caused flood damage in 25 cities, and 142 counties of 5 states; 122 deaths, and over 4.5 billion dollars in property damage resulted.

#### Preparation

There is presently no efficient way to modify or control the force of a hurricane, although experiments with cloud-seeding show some promise. Prior preparation can help to limit a hurricane's disastrous effects, however.

1. Plan a flood-free evacuation route. Your Family's Disaster Plan should include designated safe areas, areas to be evacuated during a hurricane emergency, and safe evacuation routes to shelter. Information can be obtained from the local civil defense or emergency services office.
2. Hurricanes can cause extensive flooding inland as well as along the coastline. Flood insurance is valuable financial protection. Be aware that your homeowner's policies do not cover damage from flooding unless requested and paid for separately. Check into the availability of flood insurance through the National Flood Insurance Program by contacting your local insurance agent or broker.
3. Have a supply of non-perishable food, water, first-aid kit, fire extinguisher, battery-powered radio, flashlights, and extra batteries.
4. Put up strong shutters, or attach plyboard covers on all windows.
5. Use tie-downs for mobile homes.

### Warnings

The National Weather Service can usually provide 12 to 24 hours warning of an approaching hurricane. First, a hurricane watch is issued. Then, a hurricane warning is issued when hurricane winds of 74 miles per hour or higher are reached or a combination of dangerously high water and very rough seas are expected to strike a coastal area within 24 hours.

After a hurricane warning has been issued:

1. Keep tuned to your radio or television for latest advisories and evacuation instructions.
2. Check all battery-operated equipment.
3. Have vehicles fueled.
4. Check drinking water stores.
5. Board up windows or protect them with storm shutters or tape.
6. Secure outdoor objects that might be blown away, such as garbage cans, garden tools, toys, signs, and porch furniture.
7. If you receive instructions to evacuate, do so as quickly as possible.
8. Moor your boat securely before the storm arrives, or move it to a designated safe area.
9. If flooding is a possibility, plug all drains in the house, including toilet drains.

### Procedures

During an actual hurricane, if at home, you should stay indoors and away from windows. If your house is sturdy and on high ground, remain there unless advised to evacuate. Do not stay in a mobile home, as they

are particularly susceptible to being blown over. Move to a designated shelter or safer home.

Beware of the sudden calm. You may be experiencing the calm at the center of the storm--the eye. The storm will resume with winds coming from the opposite direction once the eye has passed.

After you are sure the storm has passed, take stock of any damages. Report broken sewer or water mains. Beware of exposed electrical circuits. Don't take matches, torches, or lighted cigarettes into damaged buildings; there may be leaking gas lines which could easily catch fire. Lowered water pressure makes firefighting difficult after storms. Stay away from disaster areas--don't go sight-seeing. Avoid rivers and streams until potential flooding danger has passed. Use boiled or uncontaminated water for drinking and cooking until you are informed that water is safe. Keep tuned to radio or television stations for instructions from the local government.

For sources of help after the disaster, contact you local government or charitable organizations, and the Red Cross. Depending on the extent of damage caused, state disaster assistance centers may be opened to those who have suffered heavy losses.

A landslide is the sudden downhill slippage of rock, earth, mud, water, and other debris. Landslides may be caused by a number of factors. Earthquakes and seismic activity are among the most common causes. The sudden shifting of earth may increase slope angle, loosen debris, or cause rock to break loose from mountain and hillsides and tumble downward at high speeds. Excessive rainfall, snowmelt, explosions, or even the vibration of machinery may also weaken unstable slopes, causing collapse and sliding of material. Man's interference with nature may also cause landslides; miscalculations in engineering highways on hillsides, carelessness in mining areas, and other factors may contribute to these slope failures.

Landslides can cause immense destruction in heavily populated areas. Huge amounts of earth and rock may plunge downward so quickly that escape is impossible. Acres of property may be damaged, buildings and homes destroyed, and people buried alive. Broken utility lines, flying glass and debris, and fires from damaged electrical and heating systems are also possible dangers.

Heavy rainfall in Southern California during January of 1969, triggered landslides which caused 95 deaths and damage of \$138 million. A mining waste slide in West Virginia caused 400 deaths in 1972. A Canyonville, Oregon mudslide buried nine workers in a telephone relay station in January of 1974.

Landslides occur most frequently in hilly or mountainous regions. Hillsides barren of trees and shrubbery, and areas of frequent seismic activity are particularly susceptible. In the United States, rockslide

and rockfall occur most frequently in the White, Blue Ridge, Great Smoky, Rocky Mountains, and along the Appalachian Plateau. Several thousand rock slides have been noted throughout the Central and Western United States (most having struck in the Colorado Plateau area), Wyoming, Montana, Southern California, Oregon, Washington, and the Appalachian Plateau. Mud slides are common in the Mississippi and Missouri Valleys, the West Coast, Northern Rocky Mountain States, and Alaska.

#### ■ Preparation

Although landslides tend to strike with little or no warning, there are a few things you may do to be prepared better for the event.

1. Maintain your emergency supplies of food, water, clothing, etc.
2. Make sure you have on hand a battery-operated radio and flashlight.
3. Maintain a full tank of gas in your vehicle, and otherwise be prepared to quickly evacuate, if necessary.
4. If warnings are issued, stay posted to broadcast for further information.
5. Be aware of the risk factor in your area, and plan ahead of time where you will flee for safety, if possible.

#### Warnings

The U.S. Geological Survey issues risk maps showing where landslides are most likely to strike, and passes on such information to government authorities. When possible, landslide warnings will be

issued, and when possible, they will give the time, location, and expected severity of the hazard.

Also, be alert to the following signs of impending slides:

1. Doors or windows stick or jam for the first time.
2. New cracks appear in plaster, tile, brick, or foundations.
3. Outside walls, walks, or stairs pull away from buildings.
4. Slowly developing, widening cracks appear in the ground or on paved areas.
5. Underground utility lines break.
6. Fences, retaining walls, utility poles or trees tilt or move.
7. New water seeps or bulging ground appears at the base of a slope.

#### Procedures

1. If you find yourself trapped in the path of a landslide, flee to the nearest high ground, if possible. Do not try to outrun the slide in the direction of its path--instead run away from its path.
2. In falling rock, run for the nearest possible shelter--a stand of large trees, building, or solid structure. If you cannot escape, roll into a ball and try to protect your head as much as possible.
3. If possible, warn others of the slide by shouting, telephone, or other means of communication.

After the landslide, check for and treat any injuries. Report downed utility and power lines. Be cautious of hazards due to the



downed lines, broken glass, debris, etc. Do not return to the area until designated safe--there may still be danger of recurring slides. Be cautious in entering affected buildings, which may be structurally unstable. Examine your home for structural damage, and take procedures to correct any problems.

During a thunderstorm, electrical charges build up and separate within a thundercloud. Negative electrical charges usually accumulate in the lower portion of the cloud, while a positive charge is induced in the ground below. This produces a strong electrical attraction between the cloud and the ground beneath it. These charges may grow strong enough to overcome the insulating effect of the air between them and establish a sudden flow of current. We see this electric current as a bolt of lightning.

More lives are taken annually by lightning than by any other type of weather hazard. Only occasionally are people hit directly by lightning, however. More frequently they are rendered unconscious (or killed) either: (1) by lightning that has struck another object, such as a tree, and then carried to them in the form of smaller electrical bolts, "side flashes," or (2) by high voltage points where the lightning hits the ground.

When lightning strikes the body, heart action and respiration stop instantly; many people recover, however, particularly if critical respiration is started immediately. The injured usually have burns of various types and degrees of severity, but these are seldom sufficiently severe to require skin grafting. The two most severe complications involve the eyes and ears. Injury to the eyes may occur from the intensity of the light or the electrical energy, and deafness may be caused by the thunder.

Lightning may also strike and kill animals and damage power lines. Lightning-ignited fires destroy buildings and many of the nation's forested areas. The total annual dollar loss resulting from lightning averages about 100 million dollars.

Because lightning does not often affect large numbers of people, casualties are not widely publicized. The most notable lightning-related disaster in the United States occurred in 1963, however, when lightning struck a jet flying over Elkton, Maryland. Three engines exploded. The resulting crash killed all 81 passengers.

During 1980, in the United States, lightning killed 76 people and injured 274 others. Twenty-eight percent of the fatalities occurred while people were under trees; 22 percent occurred in open fields, ball fields, and playgrounds; 13 percent while boating, fishing, or swimming; 3 percent while golfing; 3 percent while driving tractors, farm machinery or heavy road equipment; 3 percent while using telephones; 1 percent while using citizen band radios; and 27 percent at various other or unknown locations.

The occurrence area of severe thunderstorms having dangerous lightning in the United States extends eastward from Wyoming, Colorado, and New Mexico, and includes most of the central and southern sections of the country. Florida is an area of extreme high frequency; along the Pacific Coast, severe thunderstorms are rare.

#### Preparation

Protect your family and property by having adequate insurance coverage for injury or damage caused by lightning. Know where lightning tends to strike and avoid hazardous situations.

Warnings

Severe thunderstorm warnings will be issued by your local weather service via radio and television broadcasts.

Procedures

1. Get inside if possible.
2. If you are in open country, try to get to a ditch or depression as quickly as possible.
3. If you are in a forest or wooded area, find a low area protected by a stand of small trees.
4. Stay away from farm machinery, metal equipment, etc.
5. Avoid elevated objects such as towers, trees, etc.
6. Avoid any position in which you project above your surroundings.
7. Do not enter small, isolated buildings.
8. Stay away from wire fences, locomotive rails, etc. Lightning current can travel to you from a distance through such conductors.
9. If you think lightning is about to strike, do not lie flat. Have the smallest area possible contacting the ground by kneeling or crouching with your hands on your knees.

## Chapter 18

## THUNDERSTORMS

Thunderstorms are formed by unstable conditions in the lower atmosphere. Heat energy is converted into wind, electrical discharge, and violent upward motion of the air. The storm, seen as a great cumulonimbus cloud, may be several miles across its base and tower to altitudes of 40,000 feet or more.

Destructive phenomena accompanying thunderstorms may include thunder and lightning, severe winds, heavy rain, and hail. Lightning is by far the greatest killer, taking more lives annually than any other type of weather hazard. The annual loss from lightning-ignited fires averages more than \$100 million. Heavy rains mark the mature stages of a thunderstorm, and may produce dangerous flash floods. High winds and hail may severely damage homes, property, and crops.

In July of 1975, for example, Tucson, Arizona had its most violent storm in more than ten years. Severe winds and rain caused damage of \$52 million. Streets were flooded with water two to three feet deep.

In recent years, five to eight inches of rain poured over the state of New Jersey, damaging an estimated \$30 million in crops and property, and drowning five people in the subsequent flash floods.

Events like a 16-year old boy being killed by lightning while walking along a railroad track in Florida and an Iowa woman being struck by lightning when she ran outside to close her windows are commonplace.

At any given moment, nearly 2,000 thunderstorms are in progress over the earth's surface. Occurrence of thunderstorms in the United States extends eastward from Wyoming, Colorado, and New Mexico, and includes most of the central and southern sections of the country.

Florida is an area of very high frequency. Along the Pacific coast thunderstorms are rare.

### Preparation

Thunderstorms strike quickly. Do these things before a thunderstorm threatens your area.

1. Have your emergency supplies of food, water, clothing, etc., ready. Be sure to include a battery-operated radio, a flashlight, and first-aid supplies.
2. Examine your home area for hazards. Remove any dead or rotting trees or branches in your yard to prevent falling of limbs on your home.
3. Always maintain a full tank of gas.
4. Know where you will take shelter during a storm. Your basement or fallout shelter are the safest locations.
5. Decide with your family upon a specific meeting place and communication system should you be separated from the rest of your family when a storm strikes.

### Warnings

The National Weather Service keeps constant watch on atmospheric conditions and issues watches and warnings for severe thunderstorms, tornadoes, and flash floods.

A watch means that a severe thunderstorm is likely to occur, given current weather conditions. The watch usually tells where and for how long the thunderstorm threat will exist. After a watch has been issued, listen to NOAA Weather Radio, commercial radio, or television for further information.

When a severe thunderstorm has actually been sighted or indicated by weather radar, a thunderstorm warning is issued. When a warning is received, take cover immediately if you are near the storm.

#### Procedures

When a severe thunderstorm threatens:

1. Stay tuned to radio or television broadcasts for information.
2. Have your emergency food and other supplies ready.
3. If you have time, close shutters or board up windows securely. You may also use tape to strengthen windows.
4. Secure outdoor objects that may be blown away and cause damage or injury. Bring garbage cans, lawn furniture, etc., indoors if possible.
5. If the storm becomes really severe, go to your emergency shelter spot, taking your supplies with you.
6. If you are caught outdoors, take shelter immediately. As a last resort, lie flat in a ditch or similar depression.
7. Brace outside doors, but open doors and windows slightly on the side of the house away from the storm to help equalize pressure.
8. Protect your vehicles by setting brakes and slightly lowering windows.
9. If you are on the road, take shelter as quickly as possible.
10. If you are in a boat, head for shore immediately.
11. If you are advised to evacuate, do so quickly. Take your emergency supplies, flashlight, personal documents, and identification for each family member. Shut off electricity in your home before leaving to reduce fire hazard.

After the storm

1. Listen to your radio for information and instructions.
2. Give first aid if needed.
3. Report downed utility lines.
4. Lightning and downed power lines create fire hazards. Be watchful and prepared to fight small fires if necessary.
5. Don't tie up the telephone lines except for real emergencies.
6. Drive only if necessary, and do so with caution. Debris, washed-out roads, etc. will make driving dangerous.
7. Purify water by boiling, adding purification tablets, or chlorinating, until water supply is declared safe.
8. If your power has been off for more than a few hours, check refrigerated and frozen food for spoilage.



## Chapter 19

## TORNADOES

A tornado is a violently twisting column of air that descends from thunder clouds. It is produced when cool air overrides a layer of warm air, and the warm air rises very rapidly.

Typically, tornadoes form during warm, humid, unsettled weather when there is a squall line of severe thunderstorms. Spinning top-like, the gray to black funnels often roar like an airplane or locomotive.

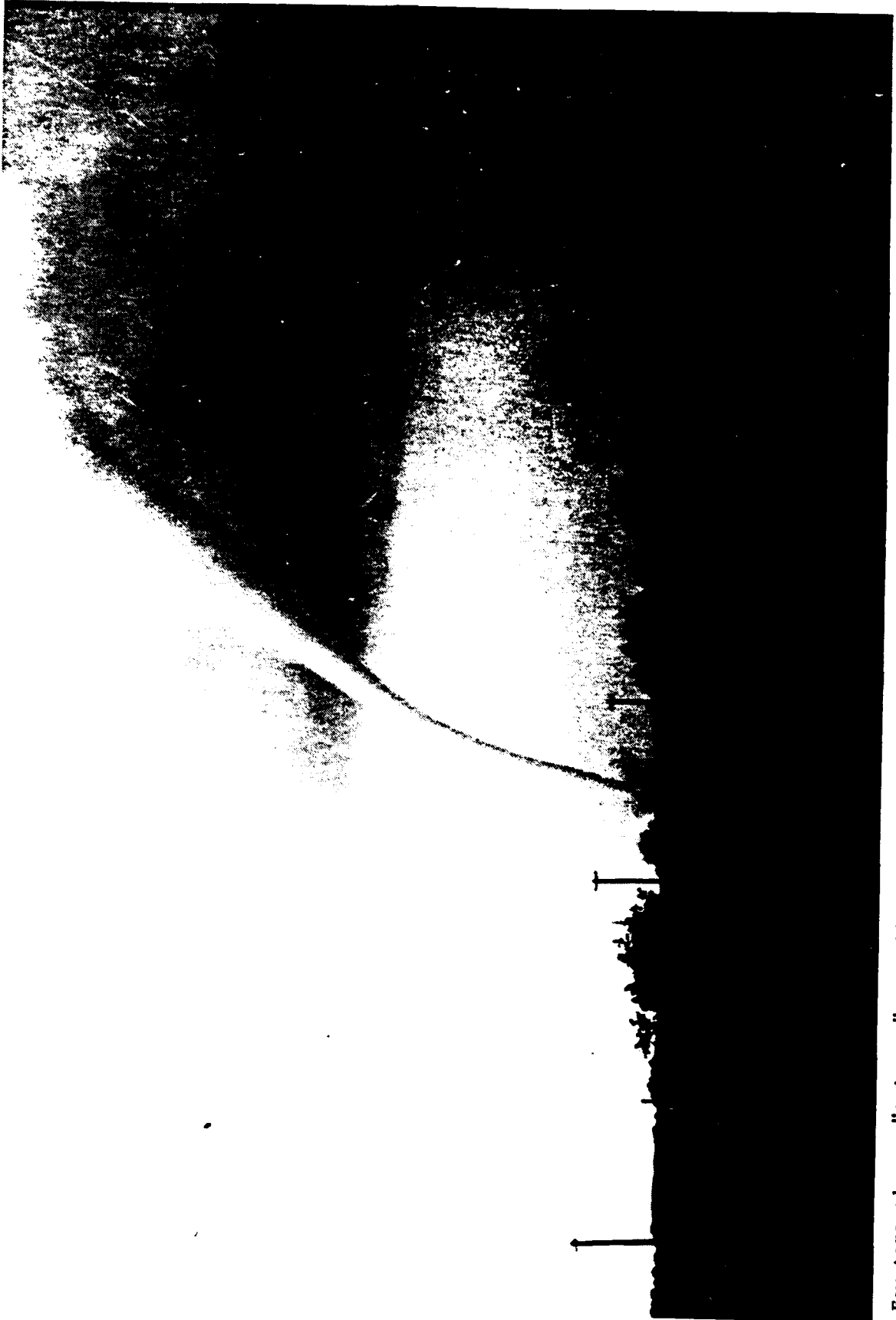
The tremendous destructive force of a tornado can leave miles of devastation in a matter of minutes. The combination of air pressure differences, strong winds, and flying debris creates a destructive, powerful force.

When a tornado passes over a building, strong winds tear at the walls, while the void in the "eye" of the tornado produces an explosive pressure difference between the inside and outside of the building, causing it to collapse. Tornadoes can uproot trees, blow down fences, lift and carry cars and even barns and houses, and seriously damage or destroy office buildings.

Examples

In April of 1974, during an eighteen-hour period, 148 tornadoes struck thirteen Eastern states. At least 315 people were killed and 5,500 others injured. Damage was estimated at over a half-billion dollars.

During 1980, 866 tornadoes were reported in the United States. They occurred on 176 days, killed 28 people, injured 1,158 others, and caused property losses in excess of 500 million dollars.



Few toronados or "twisters" are wider than 300 yards and travel longer than 20 miles, but they cause great damage through high wind velocity, sucking action, and air pressure changes. (U.S. Department of Commerce photograph of toronado clouds near Manhattan, Kansas, 1949).

Tornadoes occur almost exclusively in the United States, forming most frequently on the continental plain and the Gulf Coast. They occur in all fifty states, and during every season, striking most often during May, and least during December and January, and usually during late afternoon.

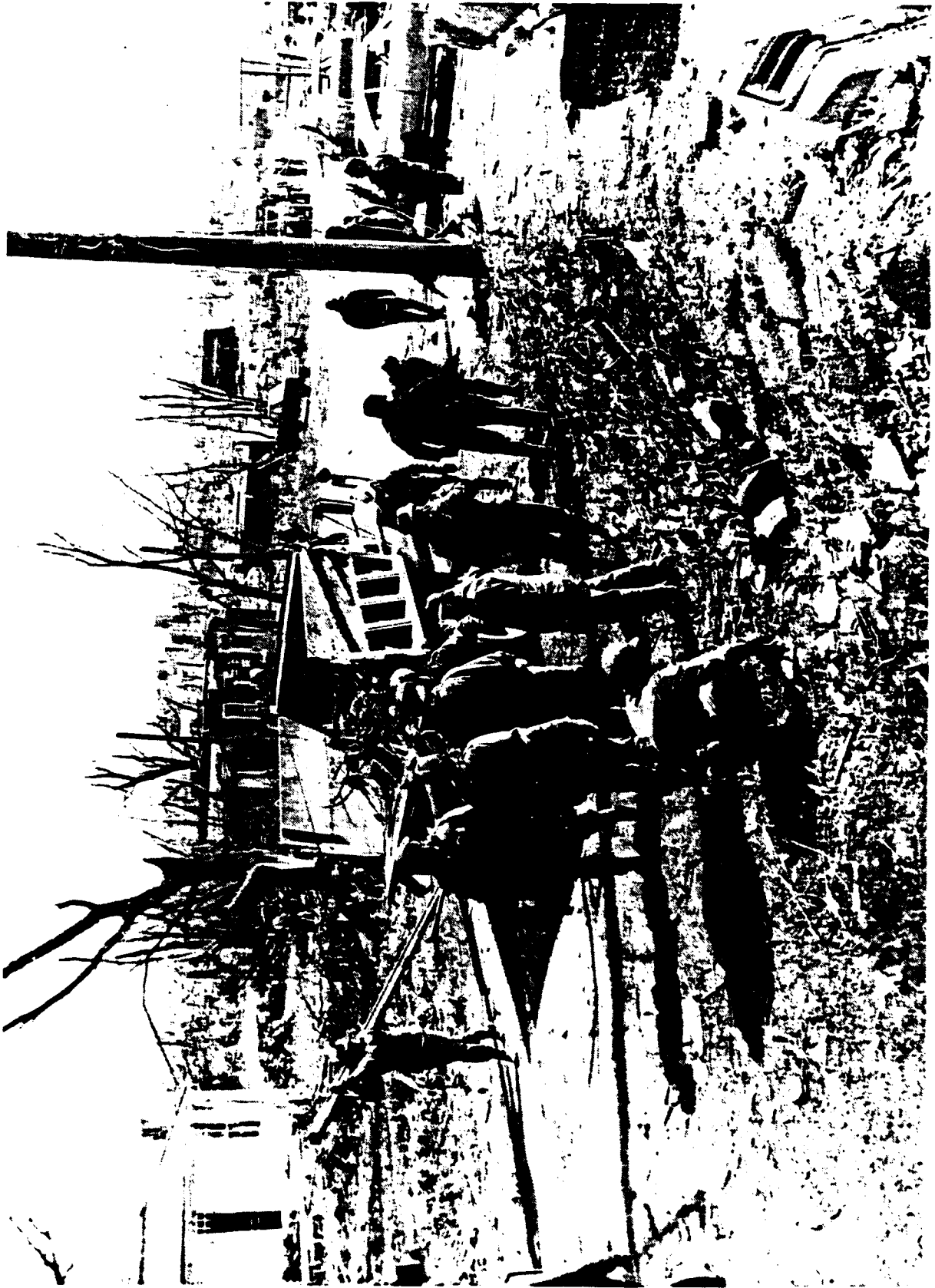
#### Preparation

There are a number of things you can do to prepare for a tornado, such as: designate or build a shelter area; store valuables in tornado-proof structures; and, if you live in a mobile home, purchase and attach tie-downs.

#### Warnings

Your community should have warning systems for tornado hazards. Listen to television and radio stations for information. A tornado watch means that weather conditions are such that tornadoes are likely to develop. A tornado warning is issued when a tornado has actually been sighted or indicated by radar.

Typically, tornadoes will form in the late afternoon on hot, humid days. Dark thunderheads form usually in the south or southwest, bringing with them heavy winds, rain, and hail. Generally the wind dies down, all becomes suddenly still; the clouds continue to move, even roll, and then one or more tinges a greenish hue, and dark funnels descend.



Cleaning up after a tornado has struck is a huge task, but help is often received by such agencies as the National Guard. (U.S. Army photograph of Ohio National Guardsmen assisting in the clean up of Xenia, Ohio, 1974).

Procedures

When a tornado warning is issued:

1. If time permits, go to a tornado shelter, cellar, a cave or underground excavation.
2. In a home or small building, go to the basement or an interior part of the lowest level.
3. If you are in open country:
  - a. Move at right angles to the tornado's path.
  - b. If there is not time to escape, lie flat in the nearest depression, such as a ditch.
  - c. Do not stay in a car.
4. If you are in a city:
  - a. Seek inside shelter in a reinforced building.
  - b. In a home, the corner of a basement offers good protection.
  - c. Standing against the inside wall on a lower floor of an office building offers some protection.
5. Keep tuned to your radio or television station for latest tornado advisory information.
6. Stay away from windows.
7. Mobile homes are particularly vulnerable to overturning, and should be evacuated.

After the tornado:

1. Use caution in entering damaged buildings.
2. Check for leaking gas lines.
3. Stay away from disaster areas--don't go sight seeing.

4. Report broken sewer or water mains to water utility department.
  5. Keep tuned to radio or television for further instructions.
- For further assistance you may turn to community organizations, the American Red Cross, and government agencies.

Chapter 20

TRANSPORTATION ACCIDENTS

With the increasingly extensive travel of Americans today, transportation accidents have become alarmingly commonplace. These accidents may be caused or contributed to by hazardous weather conditions, failure of vehicles and equipment, intoxication, and, most particularly, carelessness.

Transportation accidents may cause death or serious injury, property damage, and other hazards due to chemical spills, fire, explosions, and radioactive contamination.

The most notable U.S. air disaster occurred over the Memorial Day weekend in 1979, when a DC-10 jet crashed after taking off from the O'Hare airfield. All 225 passengers and 15 crew members died in the crash.

Eight people were killed, for instance, and 70 injured when a freight train overturned in Youngstown, Florida, spilling toxic chlorine gas over the surrounding area. In September of 1977, a fairly common but still tragic accident occurred in Beatyville, Kentucky, when a gasoline truck crashed into four stores causing a fire and the deaths of eight people.

Motor vehicle accidents are the leading cause of accident-related deaths in the United States. Over 50,000 Americans die each year in such accidents. The death rate for air travel has been estimated at .10 deaths per million passenger miles traveled, considerably safer than motor vehicle travel, which rates 1.7 deaths per million miles. Even safer is travel by rail, with an estimated .07 deaths per million miles.

Although transportation accidents are not predictable, prevention measures can help. As previously mentioned, most accidents are the result of carelessness. The following suggestions may help:

1. Always drive defensively. Watch out for the "other guy."
2. Know and obey all traffic regulations and speed laws.
3. Slow down in hazardous weather conditions. Be careful when driving at night.
4. Have your vehicles checked regularly for safety and proper operating conditions.
5. Never drink and drive, and do not allow your friends to do so.
6. Never allow children or unlicensed drivers to "steer" or to "practice driving."

#### Procedures

1. If you are involved in a transportation accident, try to be calm. Get help as quickly as possible via CB radio, telephone, etc. Listen to and follow any instructions you may receive from police, stewards, rescue persons, etc.
2. If you see a transportation accident, report it immediately. Stay out of the way of those involved in rescue operations.
3. Avoid downed wires, toxic fumes, and other hazards in the area of an accident.
4. If you are involved in a traffic accident, report it immediately to police, and call an ambulance if necessary.



## Chapter 21

## TSUNAMIS

A tsunami (tsēō na' mē) is a series of large sea waves caused by earthquakes, volcanic eruptions, avalanches, or other disturbances under the ocean. Tsunami waves travel outward from their source in concentric circles, much like the ripples caused by throwing a rock into a pond. In the open sea these waves may reach very high speeds of near 600 miles per hour. They have been known to travel up to 12,000 miles before breaking up or striking a continental land mass. Upon entering shallow coastal waters, a tsunami slows to less than forty miles per hour, but reaches wave heights of 50-100 feet.

The greatest destruction from a tsunami occurs at the water's edge. Ships in harbors are battered, sunk, or carried high onto land. Considerable damage may be caused further inland by floating debris, flooding, and oil fires. Most tsunami fatalities are the result of drowning.

Tsunamis generally occur only in the Pacific Ocean, Japan being the most frequent victim because of frequent earthquakes. The United States or one of its Pacific possessions is struck by a sizable tsunami on the average of once every eight to ten years.

Areas situated less than fifty feet above sea level and within one mile of the coast may be threatened by tsunamis of distant origin, and those that lie less than 100 feet above sea level and within one mile of the coast may be endangered by tsunamis of local origin.

Tsunamis are often very deadly. For example, on March 28, 1964, a tsunami struck Crescent City, California. The wave was believed to have



Tsunami or "tidal wave" damage can be severe as shown in this U.S. Army photograph of the almost complete destruction which occurred in the prefectures of Shikoku and Wakayams, Japan in 1946.

originated near Alaska and was responsible for 119 deaths and 104,000 dollars damage.

Another such wave struck the Phillipines, drowning 30,000 people in 1976.

In order to protect residents of areas threatened by tsunamis, the seismic sea-wave warning system (SSWWS), headquartered in Honolulu, maintains a tsunami detection and warning system. You will be informed of hazardous situations by staying tuned to radio or television stations if you live in threatened areas. Bulletins from the warning system are issued through Civil Defense and the Weather Bureau.

#### Preparation

There are a few things you can do to be prepared for a tsunami to affect your community.

1. Know the height of your street above sea level, and the distance of your street from the coast.
2. Locate the nearest safe area in the event of a tsunami.
3. Plan an evacuation route.
4. Store emergency food, water, and medical supplies.

#### Procedures

If a tsunami warning is issued, stay tuned to a radio or television station for further information. Make sure your car is fueled in case of necessary evacuation.

If you are told to evacuate, do so without delay. Take only those items which are necessary for your survival and which can be taken easily. If time permits, turn off main water and gas valves and electrical power.

Never go down to the beach to watch for a tsunami--when you can see the wave, it is too close for you to escape it.

Remember that a tsunami is not a single wave, but a series of waves. Often the subsequent waves are higher and may cause more damage than the first. Do not return to a danger area until it has been designated safe by competent authorities, and never enter a disaster area merely to sightsee.

Sources of help after the disaster may come from the American Red Cross, National Guard, Civil Defense Department, local police, and governmental and local agencies.

## Chapter 22

## VOLCANOES

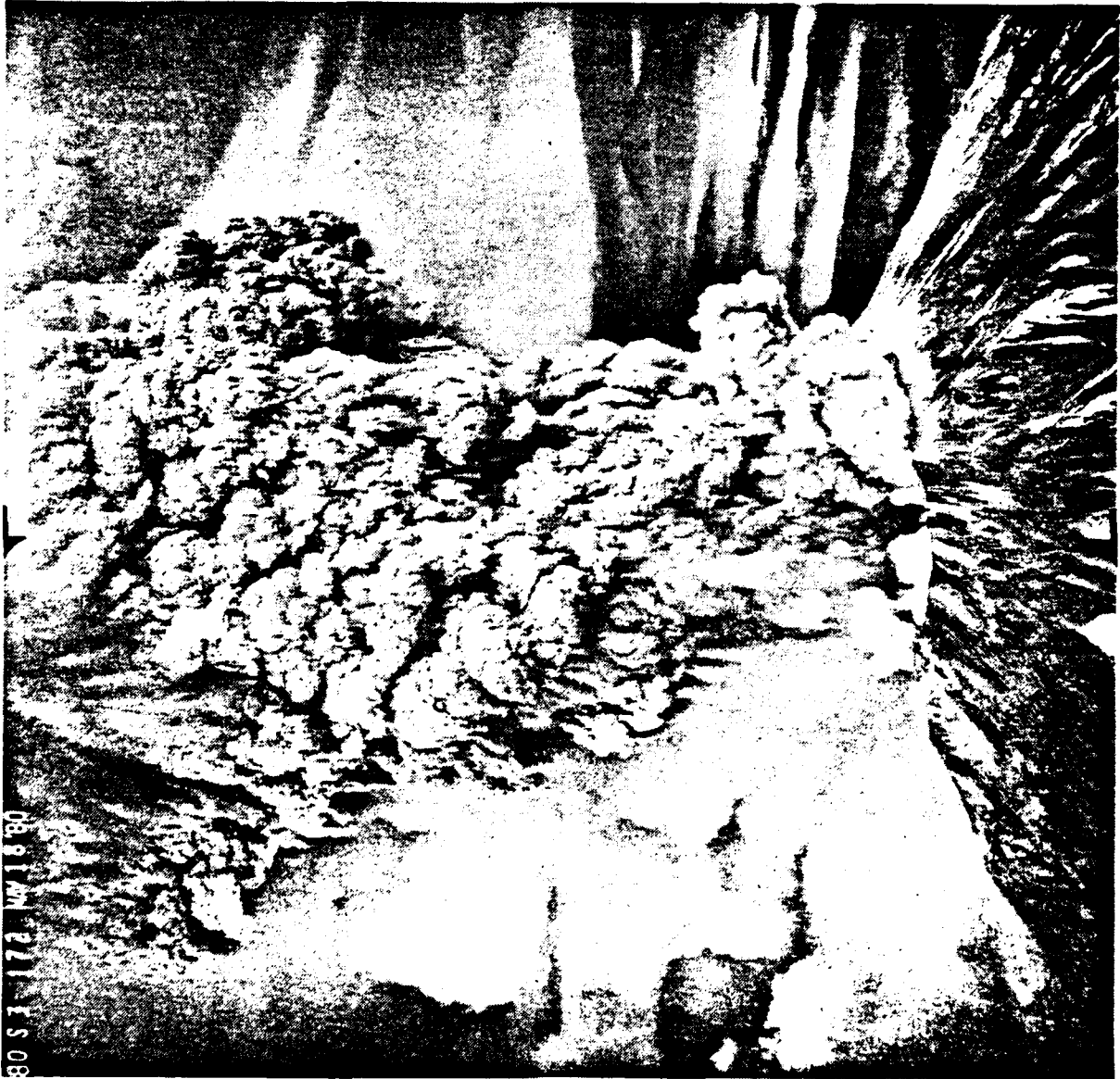
Volcanic activity is produced by the rising of molten rock from inside the earth's crust to its surface. This molten rock, called "magma," rises through the earth's crust producing volcanic eruptions, hot springs, and geysers.

In January of 1951, Mt. Lamington, set in the coastal plain of New Guinea, erupted, killing 3,000 to 5,000 people, and destroying vast amounts of sugar plantation land.

The most recent volcanic eruption in the United States occurred May 18, 1980, when Mt. St. Helens blasted out more than a cubic mile of earth killing at least 31 people, damaging 220,000 acres of timberland, burying 5900 miles of roadway, and causing some 222 million dollars in crop losses in and near Washington state.

Volcanic activity is responsible for 1,000 deaths per year. In the immediate area of a volcanic eruption, damage to property, homes, power and communication systems, and vegetation, and death to animal and human life may be caused by lava and hot debris flows and flooding. Within 50 to 75 miles of a volcano, damage is caused mainly by debris and ash fallout which may destroy crops, collapse buildings, and suffocate people and animals. Tsunami activity, as discussed in an earlier chapter, may be responsible for deaths hundreds of miles away.

Although most people associate the great danger of volcanic eruption with lava flow, this is probably one of the least dangerous phenomena. Lava flows travel so slowly that they are easy to escape, although they may do considerable damage to crops, soil and buildings. Of more concern than lava flows are the harmful ash falls produced by



The volcanic explosion that occurred at Mt. St. Helens in 1980 killed less than 50 people. A similar eruption killed 30,000 people within two minutes in St. Pierre, Martinique in 1902. (FEMA photo courtesy of Mike Smith).

volcanic activity. The ash may travel great distances, destroying crops and plant life, poisoning animals or causing them to starve, and seriously affecting human and animal respiration. When rain falls through ash-carrying clouds, or rivers are dammed during a volcanic eruption, mud flows occur. These flows generally travel the river channel, and are considered very dangerous because they are usually unexpected and travel quickly.

Volcanoes are generally termed "active," "dormant," or "extinct." About 500 active volcanoes are recognized in the world today, erupting on a continual or regular basis.

Most of the earth's active volcanoes lie in the Pacific area, with only 17 percent located along the Pacific coasts of North and South America. In the United States the major areas of volcanic activity are found along the crest of the Cascade Mountains in Washington, Oregon, and California, and in Alaska and Hawaii.

#### Preparation

You may ready yourself and your family for a volcanic eruption by locating the nearest elevated area you may flee to. Keep an emergency supply of food and water on hand, as well as protective clothing, a flashlight, blankets, and a battery-operated radio. Keep your vehicle fueled in case of evacuation.

#### Warnings

Volcanic eruptions can sometimes be predicted through study of seismic activities. Television and radio reports will warn you if a volcano in your vicinity is showing dangerous signs of activity. Deep

rumbling and trembling of the ground are signs that an eruption is imminent.

#### Procedures

During a volcanic eruption:

1. Be prepared to leave as quickly as possible.
2. Get to high ground as fast as you can.
3. Protect your skin by wearing long sleeves or other covering. Be sure to wash exposed areas later.
4. Avoid low-lying areas where poisonous gases may collect.
5. If you are caught in the open amidst debris, roll into a ball and keep your head protected.
6. If ash falls close windows, doors and fire dampers. Goggles can be used to protect eyes, and a damp cloth mask will aid breathing.
7. Stay away from lava flow.
8. Do not return to the disaster site until designated safe by proper authorities. Multiple eruptions are very common.

Following a volcanic disaster you may turn to your local police and fire department, the American Red Cross, the Salvation Army, disaster relief services and government agencies.



## Chapter 23

## WINTER STORMS

A winter storm is a major atmospheric disturbance in which precipitation falls as rain, snow, hail, or sleet, often accompanied by winds and low temperatures. Generated by disturbances along boundaries between cold polar and warm tropical air masses, these storms may churn over tens of thousands of square miles. Winter storms may range in intensity from intermittent flurries to multi-day blizzards. An ice storm occurs when rain freezes as soon as it strikes surfaces on or near the ground, putting a coating of ice on roads, wires, trees, and other exposed surfaces. Blizzards combine cold air, heavy snow, and strong winds.

From 1936 through 1978, snowstorms caused more than 3,500 deaths in the U.S. More than a third of these deaths resulted from automobile and other transportation accidents, and just under one-third to overexertion, exhaustion, and consequent heart attack. Fewer than 500 of the 3,500 deaths were from exposure and freezing. The remainder were caused by home fires, carbon monoxide poisoning in stalled cars, falls on slippery walks, electrocution from downed wires, and building collapse.

In the northern states, severe winter storms are a seasonal threat. Farther south, the occasional penetration of such storms into the usually moderate climates causes severe hardship and great crop losses.

In 1977, for example, Buffalo, New York, had its most severe blizzard on record during the final days of January. Winds gusting to 76 miles per hour, along with the month's total 69-inch snowfall, formed drifts over 30 feet high, paralyzing transportation for a week. Total

winter snowfall at Buffalo was a record 200 inches, 75 inches more than the older record set 20 years earlier.

Another record snowfall occurred on February 6, 1978, in Boston, Massachusetts, when 27.1 inches of snow fell in a period of 32 hours. Days passed before normalcy prevailed.

#### Preparation

A winter storm is an act of nature which cannot be prevented. But prior preparation and planning can greatly lessen the severity of a storm's effects. Such preparation and planning could involve:

1. Insulating your home. Caulking and weatherstripping doors and windows keeps heat in and cold out. Installing storm windows or covering windows with plastic provides further insulation. Walls and attics can likewise be insulated relatively inexpensively.
2. Maintain emergency supplies of food, water, heating fuel, and clothing. Keep a battery-operated radio and flashlight on hand.
3. Prevent fire hazards due to overheated coal or oil-burning stoves, fireplaces, heaters, or furnaces by installing adequate heat sources and, again, by insulating further.
4. If you live in a rural area, make necessary trips for supplies before the storm develops.
5. Winterize your car. Check all of the following before winter storm conditions affect your area.

ignition system	heater
battery	brakes (adjusted perfectly)
lights	wiper blades
tire tread	defroster
cooling system	snow tires installed
fuel system	chains
lubrication	anti-freeze
exhaust system tight	winter-grade oil

6. Keep a full tank of gas, and carry a winter storm car kit containing the following suggested items: blankets or sleeping bags, matches and candles, empty 3-pound coffee can with lid, facial tissue, paper towels, extra clothing, high-energy, non-perishable food, compass and road maps, knife, first-aid kit, shovel, sack of sand, flashlight or signal light, windshield scraper, booster cables, two tow chains, fire extinguisher, catalytic heater, axe.
7. Keep pipes from freezing by wrapping them in insulation made especially for the purpose or in layers of old newspaper, lapping the ends and tying them around pipes. Cover the newspapers with plastic to keep out moisture. When it is extremely cold and there is real danger of freezing, let the faucets drip a bit--this may prevent freezing damage. Know where the valve for shutting off the water coming into the house or apartment is located. You may, as a last resort, have to shut off this main valve and drain all the pipes to keep them from freezing and bursting.
8. Have some type of emergency heating equipment available in case your furnace won't operate, such as a wood, kerosene, or coal-burning stove, or fireplace.
9. Listen to weather service bulletins in order to be warned ahead of time of an approaching storm.



One of the worst winter storms to hit New England in 100 years dropped 21 inches of snowfall on Farragut Street, South Boston, Massachusetts in January of 1978, as shown in this UPI photograph.

### Warnings

The National Weather Service issues watches and warnings for hazardous weather events. A winter storm watch is issued when severe weather conditions may affect your area. A winter storm warning means that severe winter weather conditions are imminent.

An ice storm warning is issued when significant ice accumulation is expected. Freezing rain (or drizzle) means that precipitation is expected to freeze when it hits exposed surfaces. A heavy snow warning means that a snowfall of at least 4 inches in 12 hours or 6 inches in 24 hours is expected. A blizzard warning indicates that considerable falling and/or blowing snow and winds of at least 35 miles per hour are expected for several hours. A severe blizzard warning is issued when considerable falling and/or blowing snow, winds of at least 45 miles per hour, and temperatures 10°F or lower are expected for several hours.

It is also important to be aware of the wind-chill factor during winter storm conditions. At wind-chill equivalent temperatures below -25°F, exposed skin can freeze within one minute.

Wind-Chill Equivalent Temperatures (°F)			
<u>Calm Air</u>	<u>At 15 mph</u>	<u>At 30 mph</u>	<u>At 40+mph</u>
30	9	-2	-6
20	-5	-18	-22
10	-18	-33	-38
0	-31	-49	-54
-10	-45	-64	-70
-20	-58	-78	-87
-30	-72	-93	-101
-40	-85	-109	-116

Procedures

During the actual crisis period of a winter storm, there are several precautions which should be taken.

1. Stay indoors as much as possible.
2. If you must go outside, avoid overexertion.

Don't kill yourself shoveling snow.

3. Dress warmly in loose-fitting, layered, lightweight clothing. Outer garments should be tightly woven and water repellent. Wear a hat. Mittens will keep your hands warmer than gloves.

4. Watch for signs of cold weather exposure.

Symptoms include: uncontrollable shivering; vague, slow, slurred speech; memory lapses; incoherence; immobile, fumbling hands; frequent stumbling; a lurching gait; drowsiness; apparent exhaustion; and inability to get up after a rest.

Treatment: Get victim into dry clothing and into a warm bed or sleeping bag with a hot water bottle, warm towels, heating pad, or some other such heat source. Concentrate heat on the trunk of the body first. Keep the head low and feet up. Give warm drinks. Never give alcohol, sedative, tranquilizers, or pain relievers. Keep the person quiet--don't jostle, massage, or rub. If symptoms persist, call for professional help immediately.

5. If you are without heat:
  - a. use your alternate heat source.

- b. close off rooms which are not absolutely needed.
  - c. hang blankets over windows at night, and stuff cracks around doors with rugs, newspapers, etc.
  - d. have family members dress warmly, in layers.
  - e. eat well-balanced meals and quick-energy foods, such as raisins, other dried fruits, etc.
  - f. wear a hat, especially when sleeping under emergency conditions, and sleep with several light blankets rather than one heavy one.
6. Travel only if necessary. If you must travel:
- a. keep a full tank of gas.
  - b. try not to travel alone--two or three persons are preferable.
  - c. travel in convoy with another vehicle, if possible.
  - d. plan your travel and select primary and alternate routes.
  - e. travel in daylight, if possible.
  - f. check latest weather information on your radio.
  - g. if the storm exceeds or even tests your limitations, seek available refuge immediately.

("Winter Storms", Dept. of Commerce)

7. If you become trapped:
- a. avoid overexertion and exposure in attempting to free your car from drifts, shoveling snow, etc.
  - b. stay in your vehicle--you will be much safer than if you try to walk out of a blizzard.

- c. keep fresh air in you car. Freezing wet snow and wind-driven snow can completely seal the passenger compartment.
- d. beware of carbon monoxide poisoning. Run the motor and heater sparingly, and only with the downwind window open for ventilation.
- e. exercise by clapping hands and moving arms and legs vigorously form time to time, and do not stay in one position for long.
- f. turn on dome light at night, to make the vehicle visible to work crews.
- g. keep watch. Do not permit all occupants of car to sleep at once.

After the storm, the cold temperature and snow or ice may remain for several days or even weeks. You will need to maintain some of the same precautions used during the storm.

For sources of further information, listen to your local weather stations, or contact the National Weather Service. For emergency help, look to area volunteer organizations and your local chapter of the American Red Cross.



## Part III

## Nuclear Threats

## INTRODUCTION

No other type of man-made disaster has the potential for producing more casualties than nuclear attack. While nuclear-powerplant accidents have the possibility of producing loss of life, the risks of that happening are so small as to be negligible. In the case of nuclear attack, however, the potential number of casualties is high. Fortunately, the chance of a deliberate nuclear attack occurring is still very low.

The potential for producing large numbers of casualties in a nuclear attack has increased greatly since the first two nuclear bombs were dropped on the Japanese cities of Hiroshima and Nagasaki on August 6 and 9, 1945, respectively. The two bombs dropped then were not only relatively small, being about 1,000 times less powerful than today's weapons, but they also represented a relatively large proportion of the available weapons. Today, there may be a thousand nuclear weapons available for each one that was available then. And, more nations have them.

On the other hand, there has been developed a greater knowledge of the nature of those weapons and their destructive effects. We know how protection against those effects can best be achieved, and how to deal much better with the aftermath of a nuclear detonation.

This section of the handbook describes some of that knowledge. In particular, it deals with various types of nuclear emergencies, the effects of nuclear accidents or attacks, civil defense, protection from

nuclear threats, communications during nuclear emergencies, and recovering from such disasters.

## Chapter 24

## TYPES OF NUCLEAR EMERGENCIES

A number of possible nuclear emergencies could occur in the United States in addition to nuclear war. These include fallout from nuclear testing, terrorist activities, industrial accidents involving nuclear power plants, fallout from nuclear war or testing elsewhere, and threats to the U.S. by countries having nuclear weapons.

Fallout from Nuclear Testing

Fallout from nuclear testing has been measured in many parts of the world during the past quarter-century. During the 1950s aboveground testing of nuclear and other types of bombs was carried out in Nevada. Fallout from both Soviet and Chinese above-ground nuclear tests has been detected in the U.S. and Canada.

The U.S. and the USSR have long since stopped testing nuclear devices above the ground. However, France, India, and the People's Republic of China have conducted such tests. The possibility exists that further above ground tests will be conducted. Other countries might also develop nuclear capabilities in the future and insist on above ground testing.

The Pacific trust territory islands of Utiirik and Rongelap were exposed to fallout from a hydrogen bomb test conducted in 1954. The natives were unaware of the threat and took no protective actions. Later, natives began to develop fallout related illnesses. In addition, the U.S. paid Japan an indemnity for fallout-related damages which occurred from the same test. This indemnity was paid for the exposure

suffered by a boatload of 24 Japanese tuna fishermen who were in the path of the fallout cloud.

These fallout experiences indicate that some increase in deaths, long-term sicknesses, and subsequent illness such as leukemia and hypothyroidism may still result from fallout exposure of nuclear tests. This threat is still small compared with nuclear war, however.

It becomes a matter of prudence that the members of each household in America, faced with the possibility of at some time being exposed to fallout, be aware of the available protection for themselves, and others.

#### Terrorist Activities

The possibility is increasing that international terrorists, already skilled in kidnapping, bombings, assassinations and hijackings, may try to obtain the ultimate threat--a nuclear weapon. If they do, they might be in a position to hold a major city for ransom or carry out some other threat. Such danger could be minimized if the populations of every major city could be orderly evacuated and cared for in nearby shelters.

There are two methods by which terrorists or other criminals might obtain a nuclear weapon. First, a weapon might be built by terrorists or persons hired by them. Second, a weapon might be stolen intact from a military establishment.

To build a nuclear weapon requires considerable skill, but no more than is possessed by many people in the world today. The information for building one is available in public documents. In 1979, for example, a court case was heard regarding the rights of a magazine to publish plans for producing a thermonuclear bomb, a process more

complicated than making a fission weapon. Materials for putting together a nuclear weapon are also available, although to acquire some of it, terrorist-criminal activity would likely have to take place.

Obtaining an intact nuclear weapon illegally is increasingly becoming more difficult in the United States as protective systems are constantly being improved. Continual upgrading of security is necessary because past systems are now inadequate and potential thieves have gained new technology and increased their resolve. About 25,000 troops currently guard the arsenal of 30,000 weapons stockpiled in more than 100 installations in the U.S. and overseas. The task of protecting nuclear weapons in the United States is an exacting and never-ending one. While the possibility remains that weapons might be stolen from a U.S. arsenal is remote, security in some other country may not be as tight.

#### Industrial Accidents Involving Nuclear Power

As the United States changes from oil to other sources of energy, many people are concerned for safety in energy production. One concern pertains to nuclear power. A major fear is that mechanical problems or some natural disaster (such as portrayed in disaster movies) might cause nuclear accidents.

Relatively few nuclear power plant accidents have occurred in the United States. The only acknowledged nuclearpower related death was in September 1976 when a worker at a Bridgman, Michigan, plant died when he was exposed to a poisonous, though non-radioactive, gas. Three deaths occurred 20 years ago in a government test facility in Idaho in what is considered a murder-suicide involving radiation.

The "worst" accident in a U.S. nuclear power plant occurred in 1979 at the Three Mile Island Nuclear Power Plant near Harrisburg, Pennsylvania. Eight of the plant's 500 employees were hospitalized, but no serious injury occurred. Preschoolers and pregnant women were encouraged to leave the area, and thousands of them did. Officials detected radiation up to twenty miles away, but in amounts that were considered not dangerous. Overall, the Pennsylvania accident was relatively harmless, although many people were inconvenienced and frightened.

Fears regarding nuclear power plants arise, in part, from lack of knowledge. Plants cannot blow up like nuclear bombs because the uranium used in them is not the type that can develop the rapid reaction needed for an explosion.

Although the Soviets have never acknowledged the incident, hundreds of people apparently died in a nuclear explosion in late 1957 or early 1958 near Chelyabinsk in the Soviet Union. The explosion spread radioactive material over as many as 1,000 square miles. The Soviet explosion did not occur at a nuclear generator but at a nuclear waste burial ground. It is the worst disaster known involving nuclear materials.

#### Fallout from Nuclear Wars Elsewhere

Compared to nuclear weapons tests or industrial accidents, the chances of Americans being affected by fallout from a nuclear war elsewhere in the world are relatively small. However, the probability is increasing for many reasons.

First, the number of nations developing nuclear warfare capabilities is increasing. At first, only the United States had

nuclear weapons. Since the USSR developed the ability to produce and use them, a significant number of other nations, including France, the People's Republic of China, and India have also obtained nuclear armaments. It is possible that even more countries have such weapons, but have chosen not to let the rest of the world know about it.

Second, the number of available weapons is estimated at tens of thousands. This stockpile is so large that major powers would not have to use all their weapons to fight a large-scale war.

Finally, as the number of countries with nuclear weapons increases, the quality of the personnel assigned to guard and maintain them is more likely to vary. To date, no missile has ever been fired by mistake, even though emergencies have arisen. As more countries acquire intercontinental ballistic missiles armed with nuclear warheads, it may be that the quality of crews servicing the missiles and those responsible for firing them will become substandard. It is even possible that a communications system between leaders and crews could become sufficiently flawed to permit the unintentional firing of a missile during some international crisis, thus starting a nuclear war. Such dangers, while still very unlikely, are sufficient to justify planning to protect populations.

#### Nuclear Intimidation

The time may come when some nation will threaten us with nuclear weapons. The object of such threats would be to obtain something from the U.S. that it would otherwise be unwilling to give. These demands could range from an insistence that favorable trade pacts be signed, to demands for the abandonment of a mutual defense treaty with some ally, to giving up some territory. The United States might even be told that

until such demands are met, certain cities in the U.S. would be destroyed.

The Mutually Assured Destruction (MAD) policy was designed to balance the power between the Soviets and the U.S., and to prevent nuclear war. To achieve this goal, the USSR and the U.S.A. were required to equalize capabilities for conducting nuclear war. The policy has become outdated because the Soviets have now apparently developed the capability of protecting most of their population from nuclear attack. Lacking the ability to protect its citizens as well as do the Soviets, the U.S. is more vulnerable to threats from them.

The threat of nuclear intimidation is reduced when a country is able to take action which would eliminate the danger of the threat. If people know about, and take, appropriate action they can protect themselves and others from nuclear intimidation. Protective action is available which will enable most of the population to survive a nuclear attack--even one directed at destroying the population itself. It is this kind of protection which is discussed in this section.

#### Nuclear War in the United States

Of all possible nuclear emergencies which might threaten Americans, probably the least likely is a nuclear war. The primary reason for this is that destruction of humans, animals, property and natural resources resulting from such a war would be enormous. Rational leaders find such costs greater than any potential benefits derived. For example, despite the Soviet Union's extensive development of protection for its factories, it may take years before industry in the USSR could recover from a nuclear attack by the United States. The situation would be even worse in the U.S.



If a nuclear war were to occur, however, there is likely to be a step-by-step sequence of events which would make the eventual outcome predictable. These events would probably occur in three major time periods: 1) Crisis Expectant, 2) Crisis Surge, and 3) Attack Period.

#### Crisis Expectant Period

The first conditions preceding a nuclear war would constitute the Crisis Expectant Period. During this period increased international tensions would develop. The causes of such tension could be highly varied but would most likely involve one of the world's trouble spots in which the major powers would have strategic interests of substantial importance. They might initially involve relatively small populations and little territory, or they might deal with large populations and considerable territory and critical resources. During this time there would be attempts by diplomatic means to reduce the tensions. Most likely, there would be some promise of success in those negotiations, but overall a general increase in tension would be noted.

At the same time that diplomatic negotiations would be taking place, there would be a gradual build-up of military forces in each country to a point of combat readiness. Moreover, there would be an increase in the information-gathering efforts of both countries to determine the nature of diplomatic and military actions taking place. Each country's civil defense officials would be alerted to any possible need for protective measures for civilian populations. If, as the efforts of diplomats continued and the tensions further increased, the next stage in the escalation of the crisis toward a war would then occur.

Crisis Surge Period

If the crisis continued to be compounded a Crisis Surge Period would develop. In this period the heads of state would be involved in direct negotiations with high-ranking government officials. At the same time military forces would be placed on a combat alert status. That is, they would be informed that they should prepare themselves for the possibility of hostile actions. The reserve forces would be activated and placed on combat alert status as well. If successful diplomatic negotiations did not develop at this point and reduce tensions, further actions would be taken to protect civilian and government officials.

Civil defense organizations would be activated. In many countries, including the USSR, the Peoples Republic of China, Norway, and the U.S.A., such actions could develop to a point requiring large-scale civilian populations to be relocated away from major population centers.

Within the Soviet Union, the assignments made to the citizens would most likely move them to shelters in outlying areas. In the United States, similar instructions to civilians would be given. Specific shelter assignments would not be given until evacuees arrived at assigned destination sites. These sites would be places having large parking lots and shelter facilities for emergencies. Such places as football stadiums, grocery stores, shopping centers, etc., would be the destination sites protecting the populace from the immediate threats of a nuclear disaster.

Caretaker forces would remain in evacuated cities to maintain law and order and essential services. Also, commuting would be done by key workers living in outlying shelters in order to maintain production of needed commodities. If the negotiations failed, and the threats and

## **BASIS FOR CRISIS RELOCATION PLANNING**

**Nuclear attack on the United States would most likely be preceded by a period of intense crisis.**

**In that case we could have the time to relocate a major portion of our population.**

**DEPARTMENT OF DEFENSE ANNUAL REPORT  
TO THE CONGRESS  
JANUARY 1979**

counter-threats began to be implemented, the most destructive stage of the crisis would occur.

#### Crisis Attack Period

Unless warfare had been limited to conventional weapons, civilian populations would be immediately threatened in the Crisis Attack Period. If relocation had not occurred, considerable loss of life would be likely. The aggressor might decide to concentrate his efforts on civilian targets. If that happened, casualties would be higher than if the focus were on military targets.

Another factor affecting the casualty potential rate would be the time given civilians to protect themselves. It is anticipated that the minimum time necessary to implement adequate civil defense plans is four days. One of two plans--"short warning" or "long warning"-- would be implemented. In "short warning," citizens of both countries would go to public shelters to which they had previously been assigned. Additionally, U.S. citizens would be advised to go not only to public shelters, but to private residences if public shelter is not available.

If relocation plans had been carried out according to the plan mentioned above, the casualties in a nuclear attack would be relatively small. Again, it is estimated that 25 to 40 percent of the population would be destroyed even in an intensive attack aimed at civilian targets if relocation had been carried out.

Waiting Period. It is estimated that some relocated persons might have to remain in shelters for up to two weeks following an attack. By that time radiation would be reduced to relatively safe levels. At the same time, it is possible that a few people would have to remain in shelters for a longer period if radiation levels were unusually high.

WOULD THE NATIONAL ECONOMY BE  
"SHUT DOWN FOR THE DURATION"  
OF A CRISIS RELOCATION PERIOD?

**NO**

- IT WOULD BE ESSENTIAL TO KEEP CRITICALLY—NEEDED  
SERVICES AND PRODUCTION IN OPERATION:
  - POLICE AND FIRE PROTECTION FOR EVACUATED CITIES
  - PRODUCTION AND TRANSPORTATION TO SUPPORT THE  
RELOCATED POPULATION (FOOD, FUEL, PHARMACEUTICALS)
  - NEWS MEDIA
  - FINANCIAL INSTITUTIONS
  - ESSENTIAL DEFENSE INDUSTRIES
  - ALSO, ORDERLY SHUT—DOWN OF CERTAIN  
NON—ESSENTIAL INDUSTRIES
- ESSENTIAL SERVICES AND PRODUCTION WOULD BE KEPT  
IN OPERATION BY *KEY WORKERS COMMUTING FROM*  
CLOSER—IN HOST AREAS.

Moreover, living conditions in the evacuated cities might not be suitable for entire populations following an attack. There might have to be extensive rebuilding done before populations could comfortably return. People might even have to live elsewhere until living conditions were suitable in their home towns.

Instructions. Following an attack, and even during it, instructions from civil defense sources would be broadcast on the radio, TV, and other sources. These communications would be designed to give specific instructions to people who were relocated, and to those who should remain where they were. It is desirable, therefore, that battery powered radios be available for receiving such instructions.

#### Recovery Period

After the fallout radioactivity has decreased to acceptable levels (within one to two days in many communities), persons would be permitted to leave their shelters and begin the Recovery Period, during which several tasks would be done. First, assessment of damage would be required. Second, an inventory of available resources, such as food, fuel, and human resources and organizations, including private and governmental agencies, would be undertaken. Third, an appropriate plan of action would be developed. Fourth, people would be informed of this plan of action. Finally, the action plan would be implemented.

Time Required. The amount of time required for complete recovery after a nuclear attack would vary according to many conditions. The factors related to the length of time required for recovery would include the level of damage done, the availability of material and human resources, the determination of residents to implement a recovery plan, and the outside help available. Most communities that have been almost

## **U.S. ESTIMATES OF SOVIET CD EFFECTIVENESS**

- WITH SEVERAL HOURS TO MAKE FINAL PREPARATIONS, A LARGE PERCENTAGE OF LEADERS AND COMMUNICATIONS FACILITIES WOULD PROBABLY SURVIVE.

\* \* \* \* \*

- WITH TIME [A WEEK OR MORE] TO COMPLETE URBAN EVACUATION AND TO PROTECT THE EVACUATED POPULATION, CASUALTIES . . . COULD BE REDUCED TO THE LOW TENS OF MILLIONS, ABOUT HALF OF WHICH WOULD BE FATALITIES.

"SOVIET CIVIL DEFENSE"  
DIRECTOR OF CENTRAL INTELLIGENCE  
JULY 1978

totally destroyed by natural disasters such as floods and hurricanes are eventually rebuilt in a matter of a year's time, although some are never rebuilt. Communities that are rebuilt generally have considerable help from governmental and private agencies.

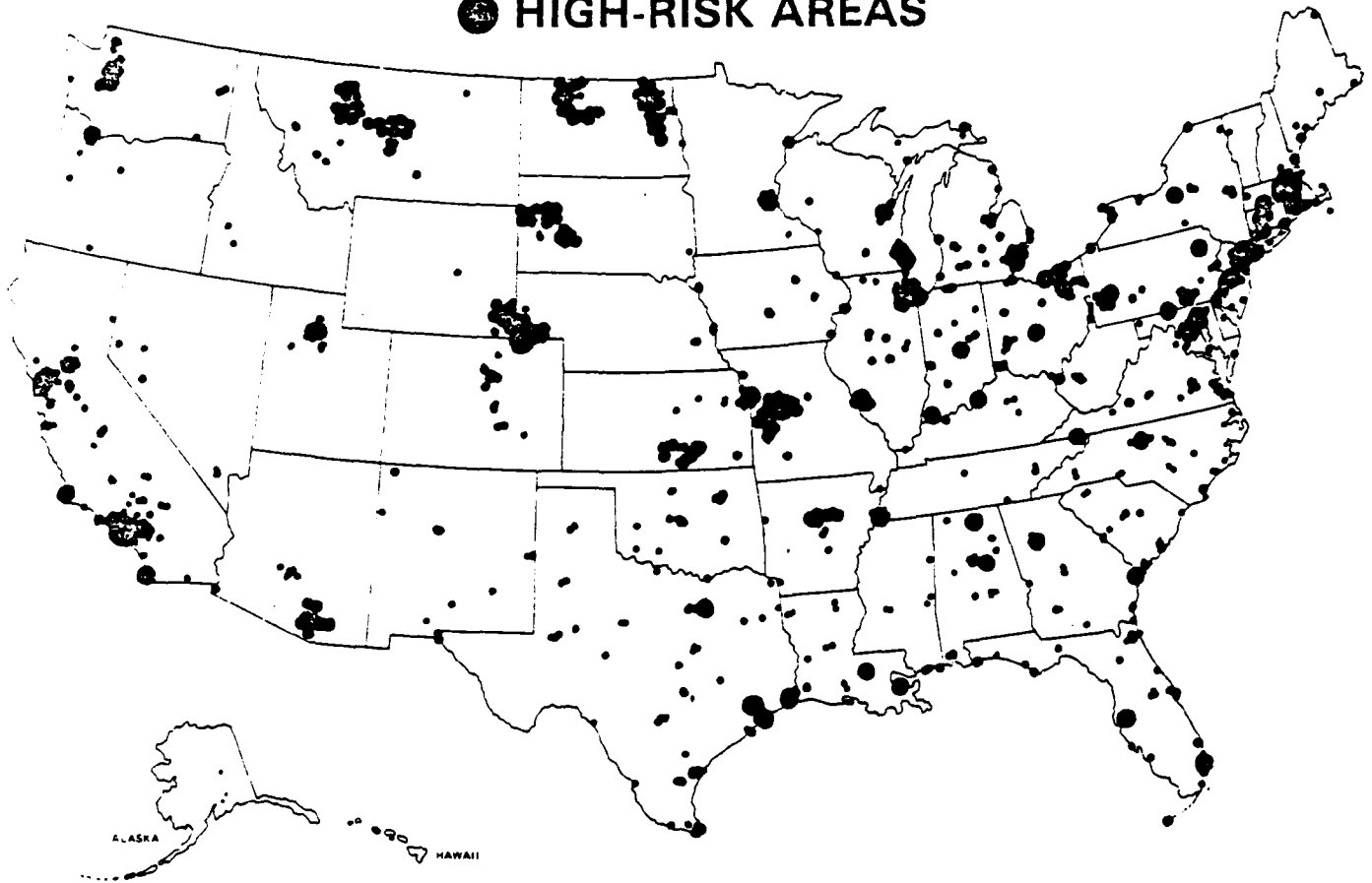
The two Japanese cities destroyed by atomic bombs in World War II, Hiroshima and Nagasaki, were rebuilt almost totally within five years, as were most cities which suffered almost total destruction from conventional bombing during World War II. Estimates give a five- to ten-year recovery period as being essential to provide complete recovery from all-out nuclear attack in the United States. The implementation of the Crisis Relocation Plan, or CRP, to move residents away from large cities and other potential target areas during the Crisis Surge Period would provide safety for the majority of the population.

#### Potential Targets

In the U.S. the potential targets for nuclear attack are generally thought to be, first, military bases. These include the missile sites located throughout the United States, the strategic air command bases, and submarine bases throughout the world. At such facilities the conduct of nuclear war is directed. Second are government centers. Third are industry/population centers in the U.S.



## ● HIGH-RISK AREAS



Many defense experts believe that military installations, particularly those having airplanes or missiles capable of destroying targets thousands of miles away, are high priority targets; and that industry/population centers are potential targets too.

## NUCLEAR EFFECTS

Nuclear attack will produce a great impact upon both society and the environment. A nuclear accident, on a small scale and much lesser degree, could also effect society and, to some extent, the environment. These impacts may vary according to the number of people involved and the nature of the disaster. The few industrial accidents that have occurred involving nuclear materials have resulted in relatively minor negative impacts. Most of these accidents have involved very few people. The 1979 Three Mile Island Nuclear Power Plant accident in Pennsylvania was an exception in terms of the number of people involved.

The major threats associated with nuclear disasters are blast, heat, radiation, social disorganization, property loss, and job loss. All of these threats are apt to occur when there has been a nuclear explosion. Only the last three may be expected in other emergencies.

Blast

When a nuclear explosion occurs, air surrounding the point of explosion is compressed and forced away from the explosion. This wave of compressed air moves quickly from the explosion point. Compressed air, traveling about as fast as the speed of sound, creates a highly destructive shock wave. This wave of air can cause "marked structural damage" to buildings and "serious bodily injury," even death, and "damage to property." Those effects are much like those occurring from tornadoes.

Blast Effects on People in the Open

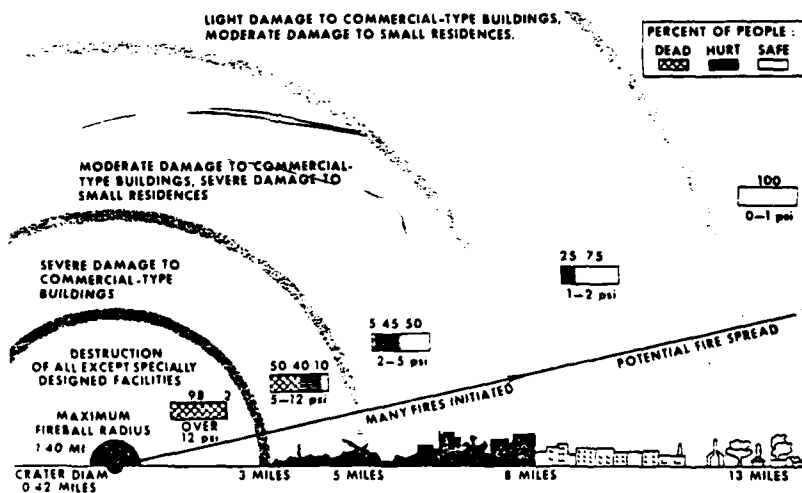
The blast threat to persons would depend upon many factors: distance from the detonation site, size of the nuclear device and protection given by surroundings. If, for example, persons were standing in the open less than four miles away from the point of detonation of a five-megaton bomb which was exploded on the ground, they would likely be seriously injured. The blast would be so severe that about one-half the people in reinforced concrete buildings would be killed.

The people would first feel a sharp shock wave pass them, followed by an increase in air pressure which would be  $1\frac{1}{2}$  times normal. The air pressure might even damage their ear drums. Then the air blast would arrive at a speed of more than 200 miles per hour. This wind would last for several seconds, long enough to propel each person through the air for a considerable distance. When they struck the ground, or worse, some other stationary object, considerable injury or even death might occur.

Damage to Buildings

The damage to buildings would similarly depend upon multiple factors. These factors would include the height at which the detonation occurred (air or ground), proximity to "ground zero," the size of the weapon, and the type of building construction. To further understand the effects of blast upon buildings, consider what some experts call a typical nuclear war situation. In this typical case, a five-megaton bomb is exploded on the surface of the ground near the center of a large city. Within a radius of three miles all buildings would be destroyed except those which were specially designed to resist nuclear attack.

# DIRECT EFFECTS OF 5 MT. BLAST (SURFACE BURST)



IF BURST IS ELEVATED TO ALTITUDE MAXIMIZING THE REACH OF BLAST DAMAGE, MODERATE DAMAGE FROM BLAST AND INITIAL FIRES ON A CLEAR DAY ARE EXTENDED FROM 8 MILES TO 13 MILES.

There would be severe damage to all commercial-type buildings (office buildings, stores, restaurants, civic buildings, etc.) three to five miles away from the detonation site. Residential homes would be a total loss.

Between five and eight miles from the point of explosion there would be moderate damage to commercial type buildings and near-total damage to small houses. Building debris and home furnishings would be blown over a large area away from the bomb blast. Trees and utility poles would be down, and water pressure and electricity would be lost for the most part.

The damage to commercial-type buildings, from eight to thirteen miles from the detonation site, would be only light. (However, there would still be moderate damage to small residences. Moderate damage to homes involves the complete collapse of some, but with most having space suitable for living. There would be broken windows, doors, studs and rafters in them. Cracked and fallen plaster and damaged roofs would be commonplace. Some tree limbs would have fallen, causing minor damage to overhead wires. Gas and water connections and pipes would be twisted and even broken in some houses.)

#### Heat

A second major threat resulting from the detonation of a nuclear weapon is heat. Persons standing in the open within eight miles of a five-megaton detonation would likely suffer burns so severe that about fifty percent (50%) of those receiving them would die. Those closer to the source of heat would suffer most. Persons out in the open on a clear day would have to be thirteen or more miles away from the explosion site to suffer no worse than first degree burns.

The heat from a nuclear explosion not only affects people but also houses, commercial-type buildings, automobiles, vegetation, and other things as well. Within an eight-mile radius of the point of detonation many fires would be started by the heat generated by a five-megaton explosion. Approximately ten percent (10%) of all buildings within that distance would be set on fire. As already mentioned the disruption of water systems within that same radius by the blast of the explosion makes firefighting very difficult. Research has demonstrated that a fire storm, such as that experienced in many German cities during World War II, is not likely to occur. Rather, while one in ten buildings would likely catch on fire, the percentage of human casualties from such fires would be only about three percent (3%).

#### Radiation

Of all the threats presented by nuclear emergencies, the radiation threat is probably the least understood by the public. Today, these fears and misunderstandings come from distorted or even false TV and movie presentations. What young child has not seen a person who was exposed to severe radiation come near or even touch someone else making them a radiated person or even a monster?

As a matter of fact, persons are exposed to natural nuclear radiation from the sun and cosmic rays throughout their lives. An additional source of radiation is received from dental and medical X-rays. Moreover, people receive very small amounts of radiation from TV sets, the production of nuclear power, and from fallout from past nuclear explosions. Nuclear radiation is a part of normal living. The concern is not whether persons are getting any--they all are--but how much they are getting.

Although a great deal is known about nuclear radiation, agreement on exactly how much radiation is safe for humans is lacking. There is agreement that people can die of too much radiation or get sick from it. But because radiation has cumulative effects, that is, the amount a person's body absorbs is built up throughout the lifetime, and because people's bodies tolerate varying amounts, precise statements of just how much is dangerous are difficult to make for all people.

Nuclear radiation is measured by instruments in units called Roentgens or Rs. Instruments that measure accumulated radiation are called dosimeters. The amount of Rs that an instrument measures in a place determines the amount of radiation to which people are exposed. The amount of radiation that is absorbed into a person's body from the exposure is measured in units called RADS. The effects of nuclear radiation are measured in Rems. One thousandth of a Rem is called a millirem. This is the unit commonly used to describe radiation exposure. Although there are differences between Rs, RADS and Rems that technically trained specialists use, for purposes of this manual they will be considered as roughly equivalent to one another.

It has been found that most Americans receive about 200 millirems per year from background radiation. Most of that radiation comes from the sun and cosmic rays. That amount is roughly equal to the radiation received from ten to twenty chest X-rays.

The federal government has set a permissible annual level of radiation exposure for the public of 500 millirems ( $\frac{1}{2}$ R), and for nuclear power workers, 5,000 millirems (5R). These standards are now under review, however, and it is possible that they might be lowered.

Most of what is known about the dangers of nuclear radiation comes from studies of persons who have received extremely high exposures or doses. These include people who survived the A-bombs dropped on Hiroshima and Nagasaki, patients massively dosed with X-rays for various ailments, and those accidentally exposed in nuclear testing and laboratories. Problems that seem to be associated with those massive doses of radioactivity, sometimes after twenty or thirty years, include leukemia, clouding of the eye's lens, thyroid cancers, and changes in genetic material. It seems now that children under ten years of age and fetuses are particularly prone to develop problems.

#### Radiation Sources

It has already been mentioned that there are numerous sources of radiation. Most of the radiation that people receive during their lifetimes comes from natural sources such as cosmic, terrestrial, airborne, water and food sources.

Cosmic Radiation--Cosmic radiation occurs when radioactive particles from outer space hit the earth's magnetic field. Most of these particles are turned away by that field, but some reach the earth's atmosphere. In the atmosphere they interact, causing charged particles to descend through it. The concentration of these charged particles is greater at higher altitudes than at sea level. In Utah, for example, which is one of the states which has a relatively high average elevation, the annual dose from cosmic radiation is about 115 millirems. The annual dose in Hawaii is about thirty millirems, and the overall average for the United States is 45 millirems.

Terrestrial Radiation--The earth is composed of rocks containing uranium and thorium in varying concentrations over different portions of



the earth. Those areas having these elements in higher concentrations have relatively more radiation emitted from the earth than others. Some areas of India, Brazil, and France have radiation levels resulting from terrestrial radiation that exceeds those allowed for radiation workers. In Colorado, terrestrial radiation is as high as 150 millirems per year. Since uranium and thorium are found in both sand and rock, buildings made from them will have higher radiation levels inside them than will frame or steel buildings.

Airborne Radioactivity--One of the natural products of uranium and thorium as they decay is radon gas. This gas diffuses out of the rocks and soil into the air. Radon gas further decays into other products that enter into the lungs of people as they breathe in dust and other particles containing radioactive decay products. Concentrations of this airborne radioactive material is higher in some places than others. For example, near sites where uranium- and thorium-bearing ore has been processed the concentrations are often high. Those concentrations are higher when the atmosphere is dry than when it is wet or when there is moisture on the ground. There are other radioactive elements in the air as well such as carbon-14, tritium, and berillium-7. In the U.S., the annual exposure to airborne radioactivity is about 4.5 millirems.

Radioactivity in Water--As water passes through the soil it picks up some minerals which are radioactive. The most common of these is potassium-40, which makes up the body's greatest natural dose of radioactivity, and radon gas.

Radioactivity in Food--All foods are somewhat radioactive. Amounts of radioactivity in food varies widely from one area to another. Health officials throughout the U.S. test food for radioactivity regularly.

Milk, in particular, is tested as it gives an accurate reading of radioactivity levels of food.

All of the above mentioned sources of radioactivity are considered to be naturally occurring or background sources. There is little reason to believe that their effects on the body are anything but normal. Body cells have natural mechanisms that repair damage caused by radiation. But if the amount of damage exceeds the ability to repair, the cells either die or begin to malfunction. It is the excessive death or malfunctioning of cells in tissues which causes undesirable biological effects.

Most Americans are not involved with laboratory or medical uses of radioactive materials, nor are very many working in nuclear power plants. Not many are likely to be directly affected by accidents there. However, there are possibilities that some might be exposed to nuclear radiation as explained in chapter 1. It is advisable to know, therefore, how that radioactive material might be transmitted to them. If such situations as mentioned in chapter 1 were to develop, the radioactive material would likely come to them in the form of fallout.

Fallout--When a nuclear explosion occurs near the ground, great quantities of pulverized earth and other debris are sucked up into the nuclear cloud. In the cloud the products of the explosion become attached to this debris, producing radioactive particles. Within a short time, these particles begin falling back down to the earth--like sand, the larger ones first, the smaller ones later. The nuclear cloud drifts over the earth, carried by the winds.

The radioactive particles that fall from these nuclear clouds are called fallout. On the way down to earth, and after they reach the

ground, the unstable radioactive materials created by the explosion decay, and, in so doing, emit radiation. These particles give off most of their radiation quickly; therefore, the first few days after an attack are the most dangerous.

Generally, the first 24 hours after fallout begins to settle are the most dangerous period for living things. The heavier particles falling during that time would be highly radioactive and, therefore, most dangerous. The lighter particles falling later would have lost much of their radioactivity high in the atmosphere.

Although fallout can be seen as dirt, grains of sand, and other materials, the rays that give off the dangerous radiation cannot be seen, felt, tasted, or smelled. The radiation given off by fallout can only be measured by special instruments.

The distribution of fallout particles after a nuclear explosion would depend on wind currents and other weather conditions. For example, rain would bring down the fallout faster than if the weather were clear. Some communities might get heavy accumulations of fallout, while others might not get any significant amounts. Any area in the U.S. has the possibility of receiving fallout.

Areas close to a nuclear explosion might receive fallout within fifteen to thirty minutes after the explosion. It might take five to ten hours or more for the particles to drift down on communities 100 to 200 miles away from an explosion.

#### Social Disorganization

In a limited emergency, social services and government are not noticeably affected for the worse. Rather, there is usually a strengthening of all social organizations. They tend to function more

effectively than in past, non-emergency situations. In local emergencies people can expect help from many social organizations. Their own family is the social organization that can provide the most help, however. The family is a private, voluntary one; yet it is remarkably effective in meeting specific needs. Most victims of floods, hurricanes, blizzards, and other natural disasters receive help from other families whether they are related or not.

During the Three Mile Island Nuclear Plant emergency, for example, most of the estimated 200,000 people who moved away from the area of potential danger moved into houses of other relatives in distant areas. Some moved into homes of friends, and a smaller proportion moved into commercial shelters such as motels, hotels, and rental homes. This was done with the aid of governmental officials in some instances, but mostly it was done with the families' own resources and contacts. Red Cross and other disaster oriented helping organizations provided shelter care as did local governmental agencies for a minority of the refugees. This pattern is typical of emergencies in the U.S.

In a larger emergency, such as a nuclear attack, it is expected that this same kind of pattern would be followed. Because of the greater destruction that would be involved, the federal and local government officials would provide more direction and information than in smaller emergencies. Still, citizens would be expected to care for themselves as much as possible.

#### Property Loss

Property losses in most nuclear accidents to date have been relatively small. Most of those suffering losses have been compensated either by private insurance funds or through the government. For

example, the tests conducted by the U.S. in the Pacific resulted in compensation paid both to islanders whose lifestyles were disrupted by the tests and Japanese fishermen who lost property and incurred radiation illnesses. At the Three Mile Island Nuclear Power Plant accident in Pennsylvania, those required to leave their homes as a precautionary measure were provided with money for lodging and food by insurers of the power plant. Most plant hospital and research employees who handle radioactive materials are covered by various kinds of insurance policies for their personal health and property. In accidents, and even small disasters which involve relatively few people, it may be expected that some provisions are available to compensate persons for at least a part of their property losses.

In large-scale disasters, however, the extent to which persons suffering such losses and the speed with which they might be compensated would vary greatly with the conditions, although substantial efforts would undoubtedly be made by both governmental and private organizations to assist.

Consider, for example, the possibility that an all-out nuclear attack might be launched on the United States. If that attack were focused on population centers, considerable property loss would be expected. More than two-thirds of the U.S. population live in urbanized areas. It is therefore possible that a considerable proportion of urban residents would suffer property losses. That these might affect many may be realized from the fact that a five-megaton nuclear detonation would destroy most of the homes within a radius of seven miles from the detonation site (ground zero or GZ).

In the event of such losses, it would obviously take some time before persons could get back possessions lost and even rebuild their destroyed homes. Priorities would be set for restoring the nation to pre-attack posture, but individual homes would be low on the list of priorities. It is more likely that an all-out nuclear attack would require people to be housed in dormitory-like situations for a few months and later in apartment-type housing for a few years before individual houses could be built again. However, considerable assistance from private and governmental agencies in making those transitions could be expected.

#### Job Loss

The amount of destruction that could occur in a nuclear attack could mean many people would be unable to work at the jobs they had worked at before the attack. If an evacuation occurred, most persons would not be doing their regular jobs until after the crisis was over. Following that, normalcy would take some time to achieve, and some people might lose the jobs that they had been trained for because in the recovery process those jobs might no longer be available.

The recovery period would require a tremendous upsurge in work opportunities, however, and employment would likely be available to a higher proportion of persons in that period than before. The emergency situation would be similar to that which occurred in Great Britain during World War II. Most younger men that were physically and mentally able were called into the service of their country. Then younger women were called. Finally, older people were utilized in the Home Guard. This guard was a branch of the Army and if an invasion had occurred they would likely have been called into battle. Such emergencies require

more of the labor force than a non-emergency situation, although the jobs required might be different than persons customarily perform.

## Chapter 26

## CIVIL DEFENSE

The system of warnings, shelters, radiological detection survival planning, and agencies organized designed to protect the civilian population from enemy attack and to deal with other natural and man-made emergencies is called "civil defense." Such systems exist in most developed countries throughout the world on a permanent basis. And, even in the most underdeveloped countries, are organized to deal with disasters as needs arise.

In the United States there are many governmental and private agencies that participate in the civil defense system. In the Federal government, the Federal Emergency Management Agency (FEMA) is most directly concerned with civil defense. FEMA is organized into ten local regions. In each region there is a regional director. Through these regional directors the efforts of FEMA are directed toward the states.

Most states have a counterpart organization to the Federal Emergency Management Agency. Their names often include the terms of "emergency services" or "civil defense." Almost every county in the U.S., and most large communities have governmental agencies whose task it is to deal with civil defense matters.

Planning, Coordination, and Control

In a major emergency, governmental, private, and voluntary agencies spring into action. Because hundreds of people and equipment are usually involved, it is crucial that some controlling agency oversee the entire operation.



This is where the mayor, the city council, and the local and state civil defense coordinators enter the picture. These people plan, coordinate, and control community services. They establish lines of authority and pinpoint the responsibilities of everyone involved. Some of the agencies that might be involved in civil defense administration are shown below:

AGENCY	FUNCTIONS
Mayor and City Council	<ul style="list-style-type: none"> <li>-Assure that warnings reach the public.</li> <li>-Assure that emergency forces (police, fire, sanitation) can deal with the crisis.</li> <li>-Assess the seriousness of the emergency by gathering and evaluating damage reports.</li> </ul>
Local Civil Defense Coordinator	<ul style="list-style-type: none"> <li>-Inspects shelters.</li> <li>-Recruits, trains, and manages shelter staff.</li> <li>-Assures that the EOC is in order.</li> <li>-Inspects and tests warning signals.</li> <li>-Tests disaster plans with staff.</li> </ul>
State Civil Defense Agency	<ul style="list-style-type: none"> <li>-Activates the state Emergency Operating Center.</li> <li>-Designates state agencies to deal with the crisis.</li> <li>-Gathers and evaluates damage reports for forwarding to the governor and to federal agencies.</li> </ul>
Federal Agencies	<ul style="list-style-type: none"> <li>-Use all personnel, equipment, facilities, and other resources to support the efforts of the state and community.</li> </ul>

SOURCE: Emergency Preparedness: A Manual for Explorers, Far West Laboratory, San Francisco, 1981.

Public Works, Transportation, and Utilities

Civil defense actions pertaining to public works, transportation, and utilities are performed by a number of agencies. Individuals and private organizations may also be involved. These groups, and their responsibilities, appear in the following chart.

Agency	Functions
Department of Public Works	<ul style="list-style-type: none"> <li>-Assesses damage.</li> <li>-Demolishes and shores up damaged buildings.</li> <li>-Removes debris.</li> <li>-Restores sanitation facilities.</li> </ul>
Utilities Service (water, gas and electric companies form a single agency to handle the crisis)	<ul style="list-style-type: none"> <li>-Restores, maintains, and operates water, gas and electricity.</li> <li>-Provides utilities in support of emergency operations.</li> <li>-Allocates utilities according to local, state, and federal priorities.</li> </ul>
Transportation Service	<ul style="list-style-type: none"> <li>-Obtains and coordinates transportation resources (buses, trains, taxis, and trucks) required by other agencies.</li> </ul>
Federal Emergency Management Agency (FEMA)	<ul style="list-style-type: none"> <li>-Provides planning and financial assistance to state and local governments.</li> <li>-Helps communities plan for tornadoes, hurricanes, floods, and other weather-related disasters.</li> <li>-Helps communities identify and reduce the hazards of earthquakes and dam failures.</li> </ul>

American National Red Cross (ANRC)	<ul style="list-style-type: none"> <li>-Has the legal obligation to provide relief for disaster victims.</li> <li>-Links private relief organizations with the state's coordination and operations centers.</li> </ul>
National Guard	<ul style="list-style-type: none"> <li>-Helps remove debris and perform other duties, if so ordered by the governor.</li> </ul>
Private Sources of Aid	<ul style="list-style-type: none"> <li>-Personnel that can be called in to help in debris removal and the restoration of public services include: utility workers, construction workers, electricians, carpenters, plumbers, taxi and truck drivers, and municipal transportation drivers.</li> </ul>

SOURCE: Emergency Preparedness: A Manual for Explorers, Far West Laboratory, San Francisco, California, 1981.

### Public Safety

In emergencies, communities must attend to the safety of its residents. Property must be protected from looters and vandals, traffic must be managed, crowds must be controlled, fires must be put out, and people must be aided. All these tasks are the responsibility of agencies that normally are concerned with public safety. These agencies, and their functions, are shown below:

AGENCY	FUNCTION
Local	
Police Department	<ul style="list-style-type: none"> <li>-Guards facilities.</li> <li>-Controls traffic.</li> <li>-Prevents crime.</li> <li>-Controls crowds.</li> <li>-Controls access to operations areas.</li> </ul>

Fire Department	<ul style="list-style-type: none"> <li>-Fights fires.</li> <li>-Searches for and rescues the trapped, the wounded, and the lost.</li> <li>-Delivers first aid.</li> <li>-Provides for radiation monitoring and decontamination.</li> </ul>
Sheriff	<ul style="list-style-type: none"> <li>-Helps police maintain law and order.</li> <li>-Cares for prisoners.</li> </ul>
State	
National Guard	<ul style="list-style-type: none"> <li>-Helps local authorities protect life and property.</li> <li>-Helps in communications, transportation, and rescue operations.</li> </ul>
Civil Air Patrol	<ul style="list-style-type: none"> <li>-Helps police and fire departments in Search and rescue missions.</li> </ul>
Department of Forestry	<ul style="list-style-type: none"> <li>-Helps protect forest against fires.</li> <li>-May provide labor for clean-up and communications operations.</li> </ul>
Department of Fish and Game	<ul style="list-style-type: none"> <li>-May aid in search and rescue missions.</li> </ul>
Other Agencies	
State Department of Corrections State Department of Youth Authority State Conservation Corps	<ul style="list-style-type: none"> <li>-May help in emergency operations such as fire fighting, and search and rescue missions.</li> </ul>

SOURCE: Emergency Preparedness: A Manual for Explorers, Far West Laboratory, San Francisco, California, 1981.

Health and Medical Services

In almost every emergency there is a need for medical services and health care. Civil defense efforts respond to these needs by organizing the resources shown below as necessary:

AGENCY	FUNCTIONS
Local	
Department of Health	<ul style="list-style-type: none"> <li>-Handles sanitation, immunization, records of vital statistics, and public health nursing.</li> <li>-Establishes a central blood bank which collects, stores, and distributes blood.</li> <li>-Establishes a central coroner's office which collects, identifies, and buries the dead.</li> </ul>
American National Red Cross	<ul style="list-style-type: none"> <li>-Adds its services to existing community records.</li> <li>-Coordinates the use of schools and other similar buildings as welfare or emergency care facilities.</li> <li>-Provides services to families, including information about dead or missing members.</li> </ul>
Department of Environmental Health	<ul style="list-style-type: none"> <li>-Sets up a command post to monitor chemical spills, air pollution, and infectious bacteria that may contaminate food and water supplies.</li> </ul>
Hospitals and Clinics	<ul style="list-style-type: none"> <li>-Devote all available personnel and resources to saving lives and caring for the sick and injured.</li> </ul>
Medical Professional Organizations	<ul style="list-style-type: none"> <li>-Draw up and distribute instructions for physicians.</li> <li>-Set up a central communication center for doctors and other medical personnel.</li> </ul>

Emergency Medical Technicians (EMT)	-Provide general medical technicians, including paramedics.  -Provide EMT dispatchers.  -Provide EMT personnel trained in the extrication of crash victims.
Federal	
Federal Emergency Management Agency (FEMA)	-May provide assistance in the form of U.S. Army field hospitals, ambulances, and medical personnel.
National Health Service Corps	-Provides physicians and nurses for community health services.
The MEDICAID Program	-Provides for payment of medical care costs for welfare recipients who may be injured, left homeless, or otherwise affected by the disaster.

SOURCE: Emergency Preparedness: A Manual for Explorers, Far West Laboratory, San Francisco, California, 1981.

#### Food, Shelter, and Financial Services

A disaster often leaves hundreds and sometimes thousands of people without shelter, food, money, and personal supplies. Local, state, and federal agencies that are most called on to help fill these needs are listed below:

AGENCY	FUNCTIONS
Local	
Emergency Services Welfare Coordinator	-Coordinates the activities of all relief agencies that respond to a disaster.
Local Housing Authority	-Assesses the damage to private houses.  -Works with federal and state officials to obtain financial aid and temporary housing.  -Finds temporary housing for victims.

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EMERGENCY PREPAREDNESS: A HANDBOOK FOR FAMILIES. (U)  
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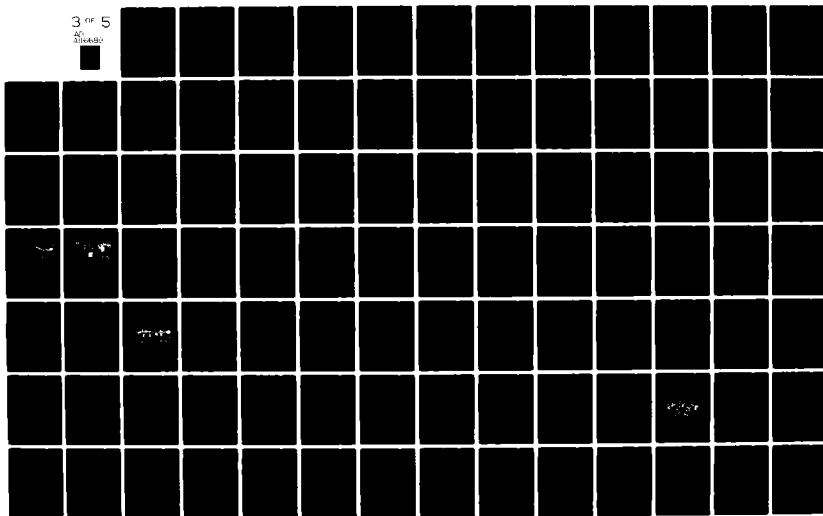
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American National Red Cross	<ul style="list-style-type: none"> <li>-Provides food, shelter, clothing, medical care, household furnishings, home repair, and occupational rehabilitation to disaster victims.</li> <li>-Provides services to families, including information about dead, missing, or injured people.</li> </ul>
State	
State Civil Defense Coordinator	<ul style="list-style-type: none"> <li>-Coordinates all the activities of state agencies, including the provision of equipment, facilities, and personnel required for emergency welfare services.</li> <li>-Manages the disaster assistance center (DAC) which is staffed by people from the state and federal agencies to help disaster victims get assistance.</li> </ul>
Board of Real Estate Brokers	<ul style="list-style-type: none"> <li>-Identifies vacant houses as well as land that is available for mobile or prefabricated homes.</li> </ul>
State Building Construction Bureau	<ul style="list-style-type: none"> <li>-Supervises the construction of mobile homes.</li> </ul>
State Unemployment Division	<ul style="list-style-type: none"> <li>-Offers unemployment benefits, (job placement and/or financial aid) to eligible residents.</li> </ul>
Federal	
Federal Emergency Management Agency	<ul style="list-style-type: none"> <li>-Offers financial assistance in the form of housing, employment, or direct financial aid.</li> </ul>
U.S. Department of Housing and Urban Development	<ul style="list-style-type: none"> <li>-Provides temporary housing for needy residents.</li> <li>-Provides funds for repair of private homes.</li> <li>-Makes mortgage and rental payments for eligible individuals.</li> </ul>



Other Agencies	
National Voluntary Organizations Active in Disaster (NVOAD)	<p>-Coordinates the efforts of national agencies that respond to community needs with food, shelter, and other necessities.</p> <p>-Members include: ANRC, Ananda Marga, Boy Scouts of America, B'nai B'rith, Church of the Brethern, Christian Reformed World Relief, Goodwill Industries of America, National Catholic Disaster Relief Committee, the Salvation Army, Seventh-Day Adventists, Society of St. Vincent de Paul, and the Volunteers of America.</p>
Private Sources of Aid	<p>-Private individuals and organizations that could help include: hotel and restaurant managers, school cafeteria personnel, YMCA/YWCA staff, apartment house owners' associations, motel owners' associations, real estate brokers, banks and state and local bar associations.</p>

SOURCE: Emergency Preparedness: A Manual for Explorers, Far West Laboratory, San Francisco, California, 1981.

#### Nuclear Attack Preparation

Civil defense agencies often have responsibility for nuclear emergencies. Public fallout shelters are identified in all large communities throughout the U.S. Locations of these shelters are available in the local civil defense offices. They have updated computer lists of such shelters available.

During peace time local civil defense officials train groups of people to cope with various emergencies. Through cooperating state colleges and universities, courses in emergency preparedness are sponsored for college credit. State civil defense offices may also provide training programs for school principals and educators so that their aid can be enlisted in time of emergency. FEMA also coordinates

activities with the State Department of Agriculture, the State Department of Health and private humanitarian agencies such as the Red Cross. In this way, FEMA is ready to provide food, medical care, and other assistance in emergencies.

WHAT DO PUBLIC OFFICIALS THINK OF CRISIS RELOCATION PLANNING?

"It would be better to have such a plan and not need it, than to need the plan and not have it"

Hon. T. Herbert Fordham  
Chairman, Board of Commissioners  
Laurens County, Georgia

If a Nuclear Crisis Occurs

What if the U.S. should have a nuclear emergency? Suppose that another nation threatens to attack the U.S. with nuclear weapons? What can be expected to happen?

Let us assume, as is most likely, that warning time would be long enough (four days to two weeks) to relocate populations from sites with highest threats. To deal with such a large-scale national emergency, FEMA, under direction of the President of the United States, would enlist the cooperation of virtually all other emergency agencies in the country. Thus, Federal, state, county, city, and community governments would all be involved in planning, coordination, and control actions. Activities would be initiated dealing with public works, transportation, and utilities. Agencies dealing with public safety would be enlisted and coordinated. Health and Medical Services would be alerted and made ready to respond to large-scale needs.

With such a nuclear emergency, first of all your family would be warned. This warning would come through the emergency broadcast station

on your radio or television or through a local newspaper. Your family would be directed to move to shelter (in your own home or in a nearby public shelter). Or you would be directed to relocate. If you moved to a public shelter or were relocated to an outlying area you would be directed to carry adequate food, medicine, and water with you.

CHARACTERISTICS OF THE AMERICAN PEOPLE RELEVANT TO CRISIS RELOCATION (1)

88% have a car available (of those without a car, 2/3 were sure they could rely on friends, neighbors or relatives to take them along).

58% say they have friends or relatives they are sure they could stay with, within 100 miles and not in another city.

33% have some camping equipment.

50% have enough food on hand for 14 days or more.

January 1979 Report on National-Sample Opinion Survey

As you relocate local public safety agencies would provide for the orderly flow of traffic to outlying rural areas. Information would continue to be broadcast over radio and T.V. You would be instructed as to which routes you should follow to your particular point of relocation. Emergency lodging would be prepared for by the local officials. Provisions would be made for the continued emergency operations of gas, electricity and water. Law enforcement would also be provided.

At the present time plans are being developed in the United States for cooperation among all levels of government to deal with both nuclear crises and natural disasters. As these plans are made, carried out during natural disasters, and then evaluated and perfected, the

capability of civil defense to more effectively deal with major,  
large-scale disasters such as a nuclear attack should be increased.

Despite opinions to the contrary, it is possible to protect people from many nuclear threats. In fact, tens of thousands of people in the United States are protected daily by appropriate action. For instance, dentists in taking tooth X-rays place protective lead aprons over the patients' bodies. In physicians' offices technicians protect themselves from X-ray effects by standing behind the leaded walls. In nuclear plants, monitoring of activities goes on constantly to warn of dangers--spills and other kinds of minor accidents. Nuclear arms storage areas are constantly guarded to protect them from the possibility of theft. Monitoring of potential offensive nuclear attacks goes on 24 hours a day as well. All of these precautions have been found to be effective in protecting people in the United States from various kinds of nuclear threats. In this section we will discuss how protection can be obtained for a serious nuclear accident or a nuclear attack.

In a previous chapter various kinds of nuclear threats were considered. In this section ways by which those nuclear threats can be minimized will be discussed. The first three threats--blast, heat, and radiation--all have common elements so far as protection is concerned. The other three threats, those dealing with social disorganization, property loss, and job loss, require more diverse protective actions.

### Blast Protection

It will be recalled that if a nuclear attack occurs, one which would be directed toward either military, industrial, or population centers, severe destruction would occur within the immediate vicinity of the nuclear detonation. The farther people are from the detonation the less likely they are to be injured by the blast. If that detonation occurred as the result of an explosion of a five-megaton weapon, for example, only those persons protected by specially designed underground shelters would likely survive within a three mile radius of the detonation. Being thirteen or more miles away from such a blast would assure reasonable safety.

There are two major options available to people for protecting themselves from the effects of blast: first, specially designed shelters have been developed for key government and military personnel. Such facilities are available, for example, in Cheyenne Mountain near Colorado Springs where the NORAD facility is housed. Other such facilities have been built near our military bases and missile sites. Additionally there are shelters near Washington, D.C., to protect the President and other key governmental personnel.

Protective shelters designed to serve that purpose only are expensive to build and maintain. Moreover, as the size and number of the weapons produced and used by potential enemies increases, the protection provided by such facilities is diminished. The best protection against nuclear threat for many people appears to require a move away from potential targets.

During recent years there has been a trend toward building houses and condominiums which are situated underground, at least in part.

These residences have the dual advantage of reducing heating and cooling costs, as well as providing considerably more protection from nuclear attacks than ordinary places. Some public buildings, particularly schools and offices are now being built underground as well. These, likewise, offer enhanced savings on utility costs and nuclear protection.

#### Heat Protection

As discussed previously, heat and the resulting fires from a nuclear explosion are life and property threatening. Like the threat which comes from blasts, protection is provided by existing underground basements, specially designed facilities, or by relocation away from the detonation site. The potential fire spread from an average five-megaton blast is minimal--thirteen or more miles away from ground zero. Again, the options for protection are to build and be housed in specially designed facilities, or to get away from potential target sites. The latter option is being used most for civil defense in the U.S. and the Soviet Union.

Some other means also used to provide fire protection are considerably less effective than specially designed buildings or moving away from target areas. These means include constructing buildings separate from one another so as to minimize fire spread; and constructing buildings with materials that are resistant to fires, such as tile or copper for roofing, fire resistant shingles, and siding on houses made from aluminum, bricks or other similar materials will also diminish fires caused by nuclear heat.

### Radiation Protection

People can protect themselves against fallout radiation, and have a good chance of surviving it by staying inside a fallout shelter. In most cases the fallout radiation level outside the shelter would decrease rapidly enough to permit people to leave the shelters within a few days or at most a few weeks. Even in communities that receive heavy accumulations of fallout particles, people may be able to leave shelters for a few minutes or a few hours at a time in order to perform emergency tasks. Information from trained radiological monitors using special instruments to detect and measure the intensity of fallout radiation would be used to advise people when it is safe to leave the shelters.

### Types of Fallout Shelters

The farther you are from the fallout particles outside, the less radiation you will receive. Also the building materials (concrete, brick, lumber, etc.) that are between you and the fallout particles serve to absorb many of the gamma-rays and prevent them from reaching you. A fallout shelter, therefore, does not have to be a special type of building or an underground bunker. It can be any space, provided the walls and roof are thick and heavy enough to absorb most of the rays given off by the fallout particles outside. This keeps dangerous amounts of radiation from reaching people inside the structure.

A shelter can be in the basement or in the corridor of any large building. The basement of a private home, a subway or tunnel, or even a backyard trench with some kind of heavy shielding material (heavy lumber, earth, bricks, etc.) serving as a roof can also provide protection. In addition to protecting people from fallout radiation,



most fallout shelters also provide some limited protection against the blast and heat effects of a nuclear explosion that was not close by.

#### A Home Shelter

A number of decisions regarding what to do about being sheltered from the dangers of a nuclear disaster need to be made by the family. These decisions have to be made less on personal preference than on availability of material conditions to provide protection. The decisions must be made as to whether or not the family's own home might be used as a shelter. Should it be converted into a shelter? If the home is not at once suitable should the family invite others to come into their home to make a survival group? Or should the family move to a shelter? If the family decides to move to a shelter, they should determine whether or not they move to another home, a retreat, or a public shelter elsewhere. Another option, so far as sheltering is concerned, is whether or not the family should make an expedient shelter. That is, whether or not the family should move away from its home and construct a shelter out of materials that are available.

#### Social Disorganization Protection

Nuclear disasters are probably more threatening to man's social organization than to any other social institutions. In the 1979 Three Mile Island nuclear accident the social impact was far more obvious than were the physical effects or threats to life. In the vicinity of the Three Mile Island plant in Pennsylvania, children and pregnant women were advised to evacuate the area. At the same time many thousands of people evacuated the area on their own initiative. Thus, the communities were greatly reduced in size until the nuclear threat was

## **"FALLOUT PROTECTION IS DIRT CHEAP"**

**MEANING, FALLOUT PROTECTION CAN BE DEVELOPED  
DURING A CRISIS BY:**

- **ADDING EARTH BESIDE AND ON TOP OF STRUCTURES  
WHICH TODAY DO NOT PROVIDE SUFFICIENT  
FALLOUT PROTECTION**
- **CONSTRUCTING EXPEDIENT SHELTERS**

**ONE FALLOUT-PROTECTED SPACE CAN BE DEVELOPED BY  
MOVING (ON THE AVERAGE) ABOUT ONE CUBIC YARD OF  
EARTH (ABOUT 70 to 100 BUCKETS FULL OF EARTH)**

over. Moreover, job productivity was diminished. Retail sales dropped. People left their jobs. Family life was interrupted as women and children were removed from the area. The plant was put out of production, reducing the jobs available in the area. Many other social impacts were felt. Fortunately, the threats at Three Mile Island were never fully realized and no one was seriously injured. Nuclear emergencies, therefore, have the potential of affecting social life greatly.

In a nuclear war the social impacts would be increased many fold. However, plans for managing the social impacts have been carefully formulated. Social disorganization would likely be within tolerable bounds for survival.

In a crisis of any kind, the best is brought out in most U.S. citizens. The worst surfaces in relatively few people. Natural disasters have proven this to be so time and again. The willingness of people in the U.S. to assist others in need has also been proven. The plan for surviving a nuclear threat in the U.S. is based upon this experience. People are expected to help others in need and to remain as independent of others' help as possible.

#### Property Protection

Inasmuch as local authorities will continue to practice during a time of nuclear crisis, the local authorities will also protect property. Provisions have been made in civil defense planning to protect the property left behind by families who choose to relocate to less threatened areas. Such planning is based on experience in natural disasters wherein police officers, sheriffs' deputies, the National Guard, and others have been designated to provide protection to

property. During floods, tornadoes, fires, and other natural disasters in the U.S., property has been protected by local authorities. Such would be expected in a nuclear disaster as well.

#### Job Protection

Depending upon the size of the nuclear disaster, whether it be a power plant accident, fallout received from other countries, or a nuclear war, it is likely that some jobs would be affected. At the Three Mile Island plant, which was closed down as the result of an accident, some workers were not able to work at the jobs which they had been trained for. However, even more workers were employed to clean up the power plant after the accident and restore it to a safe operating condition. In a larger crisis it is obvious that many people would not be able to function in the jobs in which they were previously employed. It would be some time before normalcy could be achieved. There would be a period of time, lasting for at least two weeks, in which people would be protecting themselves by participating in shelters and mass care areas. Following that they would be able to return to their homes, offices, and work.

In the event that the factories, businesses, offices, schools, or places of work were destroyed, workers would be aided in acquiring jobs elsewhere, be employed in other jobs, or retrained in other jobs, so that they would have the ability to earn a living. This general policy of helping people move to other jobs or being retrained for other jobs has been one of America's cherished values. It can be expected that it would continue.

After a nuclear disaster, the necessity for all people to work in various jobs will be increased as efforts are directed towards

eliminating the damage and rebuilding and restoring property and production facilities. Thus there will likely be more jobs available. However, some re-training and substitution of one form of work for another will probably be required of many.

#### Protecting Others

As discussed earlier in this manual, each family has a number of options available to them to insure their survival during a nuclear emergency. These options include two basic ones. First, to remain in the vicinity of the home and either go into a public shelter or to a home basement shelter. Second is to relocate away from home and move into a public or private shelter.

#### Advantages

Those who have found that their home basements provide adequate fallout protection or can be upgraded to give such and are not located in a high risk area will probably wish to choose to go to their home basements to seek shelter from fallout. A decision that will need to be made further is whether to invite others than immediate family into the basement which is to give shelter. If there is an abundance of shelter available to all families such that each family could stay in a public shelter or his own private shelter the necessity of having others in the home basement shelter is minimized.

There are certain important advantages, however, to sharing the basement with others, even under those circumstances. First, people might be invited to share who have special skills that would likely prove advantageous in a shelter experience. For example, those having special medical skills, engineering skills, electrical skills and other

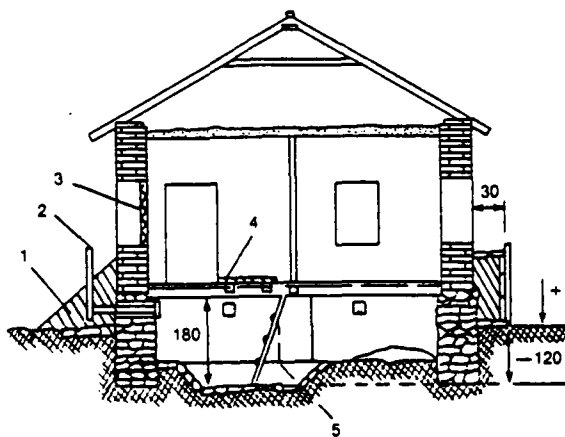
skills could be used to render first aid, to upgrade the shelter so that it would provide not only adequate, but comfortable protection from fallout and to meet various emergencies that might develop, such as fire or failure of communications. Another advantage that accrues for those sharing their basement with others is that people that are congregated together seeking shelter are more likely to have civil defense and other officials render aid if that were needed. They would be under obligation to provide services and assistance to as many people as possible. And such services would have to be given to those places where it could do the most good for the most people during emergencies.

There is yet another circumstance which would make the sharing of a basement advantageous. This would be in instances where people's lives would be jeopardized unless such sharing occurred. Such circumstances could happen in cities where there are not enough public shelters and where there are relatively few home basement shelters available. To not invite others in under such circumstances would be tantamount to inflicting radiation sickness or perhaps death on them. Fortunately, the American tradition of altruism is very strong in our country. During natural disasters it has been shown and demonstrated repeatedly that American citizens will provide help and aid to others in need even exhausting their own resources to save the lives of other people. Additionally, research has demonstrated as well that while such basement sharing will be inconvenient, it will be done wholeheartedly by most people in order to save the lives of people. The great majority of Americans are willing to take into their homes anyone no matter how different they might be from themselves in race, religion, ethnic background or cultural background in order to save their lives. In

fact, these studies have shown that most Americans are willing to sacrifice all that they have in order to preserve lives of others.

### Disadvantages

Of course there are disadvantages to sheltering others. Doing so may reduce the amount of food or water that would be available. It might also make it more congested and uncomfortable to shelter living. It might also increase the difficulty of maintaining order and control over those in the shelter. However, these latter possible advantages, order and control, seem to be more hypothetical than real in real life emergencies. If the shelter manager is aware of the necessities of performing the functions outlined in this manual for maintaining life and safety and comfort, so far as possible, and organizes those in the shelter accordingly, order is a natural by-product.



Basement of a stone house adapted for shelter: (1) earth embankment; (2) exhaust duct; (3) curtains on windows; (4) airtight hatch; (5) recessed pit. Material requirements: lumber, 0.5 m<sup>3</sup>; nails, 1 kg; earth, 3 to 5 m<sup>3</sup>; labor, 15 to 29 hours (man-hours).

Source: Office of Technology Assessment, The Effects of Nuclear War, Congress of the U.S., Washington, D.C., 1979.

## Chapter 28

## EMERGENCY COMMUNICATIONS

Maintaining communications is essential to the welfare of disaster victims. Whether contact with resources is needed for medical aid, food and supplies, or simply to reassure people that protection and assistance are being provided, communications play a major role in crisis recovery.

When living as a group in the confines of a fallout shelter, it is natural for people to feel cut off from the rest of the world. People will be anxious about what is happening to them and about what the future holds. Through communication of factual, official, and reliable information, anxiety can often be reduced and proper steps begun for recovery.

Two kinds of communications are most important: internal and external communications. Internal communication is used for coordinating all phases of daily life during emergencies. It begins with the first announcements concerning the organization of those facing a crisis together, the routines of living together, and resources needed in order to maintain survival capabilities. Such communication helps to establish order, maintain lines of authority, and organize those dealing with the crisis. Internal communication improves and maintains the survival group's morale by keeping people informed. To function properly, a surviving group's internal communications should be supervised by one or more persons who are responsible to see that pertinent information is systematically provided to all. A simple network for relaying messages and news will help control the spread of rumors, reduce anxiety, and make the crisis more bearable.



A major priority will be to establish external communication links between the family or other surviving groups and a reliable outside source of information. During an emergency situation there is a need for a centralized communications headquarters where officials and response agencies can work together to monitor the emergency, to inform the public, and to make policy decisions. In many cases, this central area is called the emergency operations center (EOC). EOCs are often located in the basement of the county courthouse or city hall, or in police or fire department headquarters.

EOCs are usually run by the chief executive in the community--the mayor or the governor in the state EOC. Usually the chief executive has appointed a director of emergency services, and this person coordinates all emergency services such as police, fire, medical, public works, and welfare services.

The EOC is the community's nerve center during a disaster. There, communications are coordinated and information from the disaster area is collected and released to the public.

#### Finding out What is Going On

One of the most reliable ways of finding out what is happening in a nuclear crisis is through the Emergency Broadcast System. This system incorporates the use of regular AM radio newsbroadcasts and can be picked up even by small battery transistor radios. This external communication will be broadcast over a number of stations in your area. If the station that you are accustomed to is not on the air, simply turn the dial and find a local station that is. Information regarding what can be done to alleviate the crisis and to live with it will be given. If it is possible to also have a television set in the shelter, or

wherever the surviving group is, this is all the more desirable. Having both radio and TV communications will reduce anxiety--most people are conditioned to feeling that all is well as long as television and radio sets are operating.

Other sources of communication include RACES, NEAR, and REACT. RACES (Radio Amateur Civil Emergency Services) is a group of amateur shortwave radio operators authorized by the Federal Communications Commission to transmit information from the state and local officials in a disaster.

NEAR (National Emergency Aid Radio) is an organization of Citizen's Band (CB) radio operators. Members of NEAR monitor emergency calls on the emergency CB channel (9), and relay messages and requests for aid to authorities.

REACT (Radio Emergency Associated Citizen's Teams) monitors CB channel 9 on a 24-hour basis and responds to calls for help from motorists and other emergency victims.

Such sources of two-way radio communication could be extremely valuable to shelter living. Many CB sets can be removed from their base stations in homes or vehicles and placed in the shelter and run on battery power.

A telephone in the shelter can be a very useful communication link. This will enable people to contact friends and relatives, to render aid, and to be in a position for receiving aid, if needed.

Other sources of information and communication which may be available include newspapers, Western Union teletype services, roving commercial vehicles, and National Guard and Civil Air Patrol communications systems.

### Learning About Radiation Dangers

Most information that is necessary to know about radiation dangers will be broadcast over local radio and television stations. The advantage of having a television set is that certain directions can be seen as well as heard, thus they will be less apt to be misunderstood.

### Learning About Blast Dangers

The dangers concerning blasts will ordinarily be given over TV and radio many hours in advance of the actual danger as part of the Crisis Surge Period. Telephones should not be used during this time unless absolutely necessary. Phone lines will be reserved for people most responsible for building the protective services for citizens.

### Getting Emergency Help

During an emergency, getting help will be severely limited. No one will want to venture out into the highly radioactive environment. Therefore, communications must be established so that emergency help can be given to those in the shelter. This can be done with two-way communications such as telephone, CB radio, or shortwave radio.

### Getting Medical Aid

Two-way communications must also be established in order to obtain medical aid. At present there are no plans to develop any sort of signaling system whereby messages may be communicated otherwise. Hence the desirability of having a telephone, CB, or shortwave radio available is further emphasized.

(Adapted from Emergency Preparedness: A Manual For Explorers, Far  
West Laboratory for Educational Research and Development, San Francisco,  
CA)

## POST-CRISIS ENVIRONMENT

Relatively few U.S. citizens have had to endure a sustained life-threatening, nuclear emergency; particularly the ultimate nuclear emergency, a nuclear war. Civil defense officials have nevertheless carried out extensive study and planning to determine what might be expected. Hundreds of research reports have indicated that there should be sufficient physical and human resources to permit a recovery from even the most severe nuclear disaster and eventually provide for reasonably desirable living. Contrary to some other opinions, the more people that survive, the better will be the chances of hastening the recovery period so that a near-normal situation will prevail. Although not all people will behave in a constructive way, the majority will. There is agreement that it will take considerable time before the economy will operate well. It will take time to develop a sound and workable monetary system. There will be a great many opportunities for work, for development, and for rebuilding the devastated cities.

Qualities of Life Change in Recovery

If "quality of life" is considered to be the manner in which people live, taking into account the population, material resources, and social and economic institutions, the overall "quality of life" will be seriously reduced in any nation jeopardized by a nuclear attack. The immediate consequence of an all-out attack will be a sharp drop in quality of life with millions of dead and injured, great destruction of resources, disorganization of institutions such as government, banking,

private ownership, and the like, and the need to spend a considerable amount of time in fallout shelters.

The initial sharp drop in quality of life would be followed by an even further decline because of fallout radiation exposure, deterioration of factory machines, waste of scarce resources, lack of communications, and general social disorganization. In sum, after coming out of the shelter, the quality of life would be diminished until efforts are made to reproduce the vital materials used by people for survival.

After production of food and other necessary commodities is again begun, an end to the decline in quality of life would occur. After the "bottoming out" occurred, the nation would be on its upward path to recovery.

There is a possibility that in some countries in which a severe crisis occurs deterioration might be so severe, or management so inept or misdirected that national recovery might not occur at all. In that circumstance the quality of life would deteriorate to one of the levels of primitive societies, such as food gathering or hunting or primitive horticulture, with no centralized government.

It is far more likely that such a circumstance should occur, if it occurred at all, in countries that have had less experience with national responses to emergencies, both natural and man-made, than has the United States. Indeed, the United States has dealt with many national and international emergencies, and experience will be profoundly helpful in working out the very challenging issue of the aftermath of a nuclear attack.

### Redeployment and Economic Recovery

Studies show that economic productivity would decline for at least two years following an all out attack on the United States. It would take this long for plants to be rebuilt, machines to be renovated and to be developed so that productivity could again begin to increase toward a level that the nation was once on. It would be difficult for most individuals to get back the same job that they had prior to the attack. And it could take many, many years before the quality of life is fully restored.

### Restoring Utilities

The first post-shelter hurdle that must be overcome is to provide essential water, food, and protection from the elements. It will be necessary for all of those in the post-shelter environment to be prepared to participate in getting these essential needs met. The first of these is the restoration of an adequate water supply.

### Public Health

Survivors of a nuclear attack may be exposed to diseases capable of rapid development to epidemic proportions. The need for disposal of human waste and personal cleanliness is an important reason why water service must be restored promptly. First, this implies that provision of electric power for sewage treatment plants and sanitary lift stations must have equal priority. Where damage has occurred, repairs to the sanitary waste disposal systems must be scheduled concurrently. It may be expected that priorities will be given to providing water and electricity to such needs even before they are given to the public for their own housing purposes.

### Treatment of Injured Survivors

In the immediate post-crisis period, treatment of wounds and broken bones and burns will create an overwhelming demand for services of physicians and surgeons. There is no specific treatment of radiation sickness beyond bedcare, cleanliness, and replacement of fluids. This can be provided by relatively untrained personnel. Proper treatment of injuries and burns, however, would place a heavy demand on those who possess these specialized medical skills.

A characteristic of nuclear attack is that a number of surviving injured are expected to equal or exceed those killed by the blast. There could be tens of millions of injured survivors throughout the nation. Since today there are only about 1.5 physicians and ten auxiliary medical personnel (dentists, nurses, veterinarians, etc.) per 100 population, case loads would be many times normal even if emergency plans distributed emergency personnel in most shelter locations. It may be expected, therefore, that medical treatment will be much less than adequate at best. Nevertheless, it is helpful to know that three-fourths of the surviving injured will survive without medical care. About fifteen percent (15%) of the surviving injured will succumb during the thirty-day period following an attack, despite maximum care. Only about ten percent of the surviving injured can be saved by adequate medical care. It will be virtually impossible to provide that care for all survivors.

### Expanding Public Safety Forces

Most regular public safety functions of local government should be resumed before the release of the general population from shelters after



an attack. If the normal population has been greatly increased by an influx of survivors from areas more severely affected, most of the regular public safety tasks will require longer work shifts, increased manpower or both.

A large expansion in the numbers of auxiliary police, guards, and watchmen would be necessary. These people would not need much training in most cases, but they would need to be selected and recruited and would need professional supervision. It may be expected that the quality of public safety function will not be as high as that which is attained prior to the emergency.

#### Ecological Recovery

Some significant ecological consequences may well occur as part of the post-shelter environment. These potential ecological consequences include the possibility of cooler growing seasons, temporarily increased rainfall, fire in dead pine forests, increased erosion and silting, and outbreaks of insects and rodent pests. All of these could have an indirect effect on agriculture and forestry and consequently a detrimental effect on the production of food and fiber.

Trees, especially pine, are vulnerable to fallout radiation. The loss of a forest can be regained only after many decades. Dead trees are a valuable resource for wood products if they are harvested. If they are not harvested they become a refuge for insects, pests, and plant diseases. They also become a fire hazard. Prompt harvesting and reforestation are post-attack actions needed to control these consequences.

### Fallout Radiation Effects on Insects, Animals, and Agriculture

A major concern would be to revitalize pollination capabilities after a nuclear attack. Bees, for example, are essential to the pollination of certain agricultural crops, particularly fruits. A large reduction in the natural population of birds and preying insects could produce severe crop infestations by parasitic insects. But man is not helpless; he can move bee colonies where they are needed. He can import or otherwise assist the populations of certain areas with beneficial species. All of these actions could be called ecological defense. They will have to take place before the quality of life can be normal.

With all of its difficulties, the post-crisis environment will be one in which there is both life and challenge. It is likely that most survivors would behave constructively and that the numerous management problems could be solved in time. This is particularly true in the U.S. where the free enterprise system has emphasized public-oriented leadership, dissemination of information, and reassurance and personal response by government to the needs of the people. At the same time some very hard decisions will have to be made, which the population will need to understand are necessary for the growth of the majority.

### Restoration of the Shelter Facilities

One other task that should be done is to restore the shelter facilities to a state where they could be used again if necessary. This will be more difficult in the post-crisis environment because shelter supplies will have been used throughout the country and may be in short supply. Nevertheless, it is advisable to do as much as possible to make sure that the shelter might be used again.

One advantage of having gone through the shelter experience is that it will be known what is needed and what works well. This experience will help shelter owners bring into the shelter only those things which will be necessary or those things which will enhance comfort and livability.

## Part IV

## Nuclear Disaster Preparedness

A great deal has been said and written about the possibility of surviving nuclear attack. Many responsible authorities claim that nuclear war would be the end of the world. Others, tend to discount the effects of nuclear war, and even indicate its possible beneficial results in reducing overcrowding and population pressures. The predominant view amongst those who have thoroughly tested nuclear weapons is that nuclear war would produce unprecedented destruction, but that the majority of those who are prepared could survive.

In the next six chapters, suggestions for preparing families for nuclear attack are given. Not only are urban shelters discussed, but shelters in rural areas as well. Management of these shelters is outlined, and some rudimentary first-aid techniques are given. Supplies necessary for surviving a nuclear attack are described, and emergence from those shelters is presented together with a discussion on what might be expected following a nuclear exchange.

Despite very gloomy predictions to the contrary, surviving a nuclear war is very likely--provided adequate shelters are developed, necessary supplies obtained, skills for treating illness and injury acquired, and the know-how for enduring and dealing with a changed world developed.

## CHAPTER 30

## SHELTERS

Before a nuclear emergency occurs, each family or household group ought to decide whether they can use their own home as a shelter, or whether they must find shelter elsewhere during a nuclear crisis. In making this decision several factors should be taken into consideration.

Determining Nearness to Potential Nuclear Targets

First, families should determine their distance from potential target sites. High priority targets are military establishments, buildings housing top government officials, and highly populated cities. It would also be prudent to consider most large cities in the country as possible target sites. Families living within a nine-mile radius of possible target sites would do well to relocate to less populated areas, unless their residences provide especially-designed ("hardened") protection. Those families living nine or more miles from potential target sites could consider their homes as being used as possible shelters.

In making the decision to relocate or to utilize a family home for protection, it should be remembered that very few homes within a nine-mile radius of ground zero could survive a megaton-sized nuclear blast. Even if people were in basements or crawl spaces within that radius and thus survived the initial blast, radiation, and heat waves, they would still have to consider the fire, fallout, and other post-detonation threats. Moving from such target sites is very desirable.

A Public Shelter. Civil defense plans call for most people to be cared for in public shelters as compared with other types of shelters. A large-scale nuclear emergency will be directed by Federal government officials. National plans for major nuclear crises call for putting people into public shelters as a first priority. There may not be time during an emergency to instruct people on how to determine the worth of their own homes as shelters, how to upgrade them, or use them. During a nuclear emergency, however, instructions would be given for people to evacuate potential high-risk areas. They would be told by government officials where to go and what to take. They would in turn be directed to public shelters upon arrival. If insufficient time is available, however, public shelters in high risk areas might also be used.

#### Moving to a Shelter

Moving to a shelter is desirable under the following conditions:

1) When a person's own home, apartment, or domicile is not suitable for a fallout shelter, or 2) even if it is and a person lives in a high risk area, it is generally desirable to move to a shelter elsewhere, provided there is time.

How to Get There. If you have a car, truck, camper, or recreation vehicle available, drive it to your designated reception area, using the route given by your local officials. Public transportation will be used for others. Remember that several days should be available for relocating all those living in the high risk area. Take the time you need to prepare and pack.

A relocation route will be designated to assure that residents will be equally distributed among the reception counties so there will be adequate food and lodging for you and your family. If you use a route

not assigned to you, you may find the reception area you have chosen is filled and there is no room or accommodations for you. Follow the relocation route to the reception county as indicated by your local officials. Whenever possible, police officers will be on duty to advise and direct you. Obey all instructions by law enforcement officers.

If you get caught in a traffic jam, turn off your engine, remain in your car, listen for official instructions, and be patient. Do not get out of line to find an alternate route. All routes will be crowded. If traffic is stopped for an hour or more, do not leave your car for any reason.

Be sure you have adequate gasoline when you start out. DO NOT BUY ANY MORE GAS THAN YOU WILL NEED. Gasoline will be in short supply and will be needed to provide you with food and other essential supplies. But if you run out of gas or have other mechanical difficulties, move your car to the side of the road out of traffic lanes to allow traffic to continue. It is planned that service to stalled autos will be available during the evacuation period. Leave your hood up as a sign that you are stalled and you will be assisted as soon as possible.

If you have no private means of transportation, public transportation will probably be provided to move you to your reception area. If you are physically unable to get to transportation, make arrangements to be picked up and transported to your reception area.

What to do When You Arrive. When you reach a major community or town in your assigned reception county, proceed immediately to your assigned reception area. You can find this by following signs with the number of the last digit of your auto license plate, for example.

At the center you will register yourself and your family. Reception county officials will make every effort to assign you to a place to sleep, in a large building or possibly with a private household that has volunteered to share their home.

Lodging in Public Buildings. If you are assigned to a public building such as a school, church, or other temporary lodging center, do everything you can to help maintain order and sanitary living conditions. Elect a leader and form working groups to help local officials and volunteers with such tasks as:

- \*Cooking and feeding services
- \*Providing water supply
- \*Cleaning up trash and garbage
- \*Maintaining order
- \*Assuring quiet during sleeping hours
- \*Organizing recreation and religious activities
- \*Arranging medical care for the sick and assisting the handicapped
- \*Upgrading facility protection
- \*Fire protection/fighting
- \*Radiological monitoring
- \*Providing adequate ventilation

If You are in a Hospital. Most hospital patients would probably be relocated. However, if it should be impossible for you to be moved because of special requirements during the relocation period, every effort would be made to care for you. Similar consideration would be given to people in other institutions. The best available shelter and care would be provided in case of imminent attack.

#### Determining the Protection Your Home Can Offer

It is fallout that is the greatest threat to families located nine or more miles away from a potential detonation site, and hence, not all homes can serve as safe shelters.

It is fairly easy to determine whether or not a home will make a suitable fallout shelter. The basements of some homes are already



usable as family shelters, especially if the house has two or more stories and its basement is below ground level. However, most home basements need improvements in order to shield occupants adequately from fallout. Homeowners may be able to make these improvements at a low cost and with moderate effort. Such improvements should be made prior to an emergency, however, when no danger exists and materials are available.

If you do not already have information about fallout protection provided by your residence, you may obtain it quickly as follows:

Select the answer in each multiple choice question from the Shelter Protection Table which most nearly applies to your home. Write the number of points selected in the blank space provided opposite each question. Add the numbers written in the blanks. Write the sum in the blank opposite "TOTAL POINTS" and compare your total with the guide at the bottom of the table.

#### SHELTER PROTECTION TABLE

1. How many stories are above the ground level in this house?
 

<input type="checkbox"/> One story	3 points	
<input type="checkbox"/> One and one half stories	6 points	
<input type="checkbox"/> Two stories	9 points	
<input type="checkbox"/> Three stories or more	11 points	_____
  
2. What is the maximum height of any basement wall above the ground?  
(Exclude outside doors of three feet width or less.)
 

<input type="checkbox"/> No basement (skip question 3)	0 points	
<input type="checkbox"/> 3 feet or more	1 point	
<input type="checkbox"/> 2 to 3 feet	3 points	
<input type="checkbox"/> 1 to 2 feet	8 points	
<input type="checkbox"/> less than 1 foot	15 points	_____
  
3. What is the principal material of the basement walls?
 

<input type="checkbox"/> Cinder block or concrete block	0 points	
<input type="checkbox"/> Stone, brick, or poured concrete	2 points	_____
  
4. What is the principal material of the first story walls?
 

<input type="checkbox"/> Solid brick, stone and concrete	5 points	
<input type="checkbox"/> Other	3 points	_____

5. Is the home attached to or closer than ten feet to another home or homes of similar size and construction?

- |  |          |
|--|----------|
| <input type="checkbox"/> No              | 0 points |
| <input type="checkbox"/> Yes, 1 side     | 1 point  |
| <input type="checkbox"/> Yes, both sides | 2 points |

\_\_\_\_\_  
 \_\_\_\_\_  
 TOTAL POINTS \_\_\_\_\_

Fallout Shelter Potential: Up to 13 points - low  
 14-19 points - improvable at low cost  
 20 or more points - adequate

### Manufacturing Shelters

If your home basement--or one corner of it--is below ground level, your best and easiest action would be to prepare a permanent type family shelter there. If you have basic carpentry or masonry skills, you can probably buy the necessary shielding materials and do the work yourself in a relatively short time.

In setting up any home fallout shelter, the basic aim is to place enough shielding material between the people in the shelter and the fallout particles outside. Shielding material is any substance that absorbs and deflects the invisible rays given off by the fallout particles outside the house, and thus reduces the amount of radiation reaching the occupants inside the shelter. The thicker, heavier, or more dense the shielding material is, the more protection it offers.

Some radiation protection is provided by the existing standard walls and ceiling of a basement, but other shielding materials will have to be added. Concrete, bricks, earth, and sand are some of the materials that are dense or heavy enough to provide fallout protection. For comparative purposes, four inches of concrete provide the same shielding density as:

- \_\_\_\_\_ 5 to 6 inches of bricks.
- \_\_\_\_\_ 6 inches of sand or gravel. May be packed into bags, cartons, boxes, or other containers for easier handling.
- \_\_\_\_\_ 7 inches of earth . . .
- \_\_\_\_\_ 8 inches of hollow concrete blocks (6 inches if filled with sand).
- \_\_\_\_\_ 10 inches of water.
- \_\_\_\_\_ 14 inches of books or magazines.
- \_\_\_\_\_ 18 inches of wood.

#### A Pre-planned Basement Shelter

It is possible to improvise adequate shelter for a home basement using relatively inexpensive available materials. This shelter will provide protection, and can be constructed in most parts of the country. Made of concrete blocks or bricks, the shelter should be located in the corner of your basement that is most below ground level. It can be built low, to serve as a "sitdown" shelter; or by making it higher you can have a shelter in which people can stand erect. The shelter ceiling, however, should not be higher than the outside ground level of the basement corner where the shelter is located. The higher your basement is above the ground level, the thicker you should make the walls and roof of the shelter, since your regular basement walls will provide only limited shielding against outside radiation. Natural ventilation may be provided by the shelter entrance, and by the air vents shown in the shelter wall, but will usually have to be supplemented by an air pump of some sort. One such pump is described in the appendix. This shelter can be used as a storage room for other purposes in non-emergency periods.

If your home has a basement but you do not wish to set up a permanent type basement shelter, the next best thing would be to arrange to assemble a "preplanned" home shelter. This simply means gathering

together the shielding material you would need to make your basement (or one part of it) resistant to fallout radiation. This material such as sand, bricks, and books could be stored in or around your home, ready for use whenever you decide to set up your basement shelter.

There are many kinds of preplanned basement shelters that can be derived. For example, the "snack bar plan" consists of a snack bar built of bricks or concrete blocks set in mortar in the "best" corner of your basement (the corner that is the farthest below ground level). It can be quickly converted into a fallout shelter by lowering a strong, hinged "false ceiling" so it rests on the snack bar. When the ceiling is lowered into place in time of emergency, the hollow sections can be filled with bricks, concrete blocks, or sand bags, these materials having been already stored conveniently nearby as room dividers or recreation room furniture.

More detailed descriptions and blueprints for preplanned home basement shelters may be obtained by writing for your free copy to: Federal Emergency Management Agency, Washington, D.C. 20472, Attn: Printing and Publications. Be sure to mention the title of the plan you want.

The fallout protection offered by your home basement also can be increased by adding shielding material to the outside, exposed portion of your basement walls and by covering the above ground portion of the basement walls with earth, sand, bricks, concrete blocks, stones from your patio, or other material. You also can use any of these substances to block basement windows and thus prevent outside fallout radiation from entering your basement in that matter.

Making An Expedient Shelter

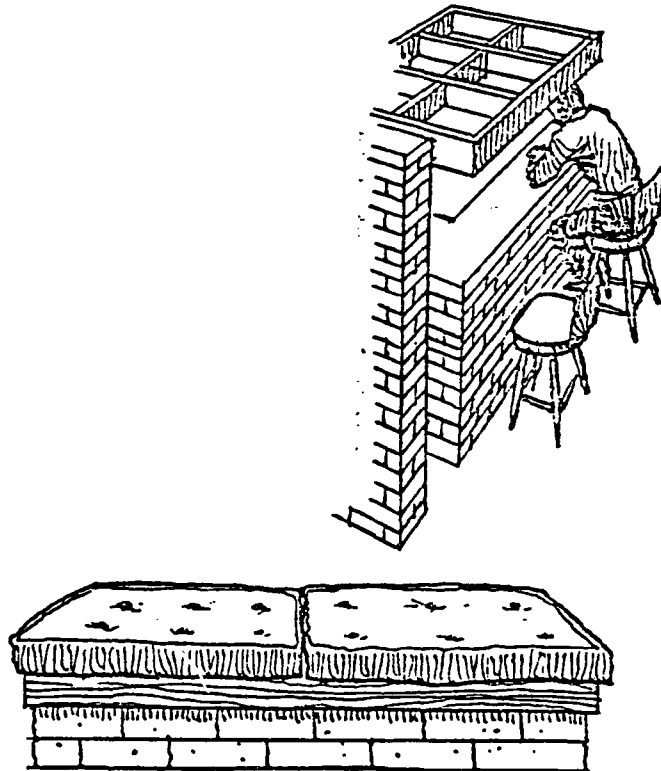
If your home is located near a target area, a nuclear attack may result in its being destroyed or having a high potential of being destroyed. You will most likely wish to move away from that area to another place, either in a public shelter elsewhere or a home basement or other shelter areas. It is possible as well to build of available materials a very satisfactory shelter that will resist not only fallout but blast. These materials are such that a family could take with them and build within a two-hour period a very adequate shelter.

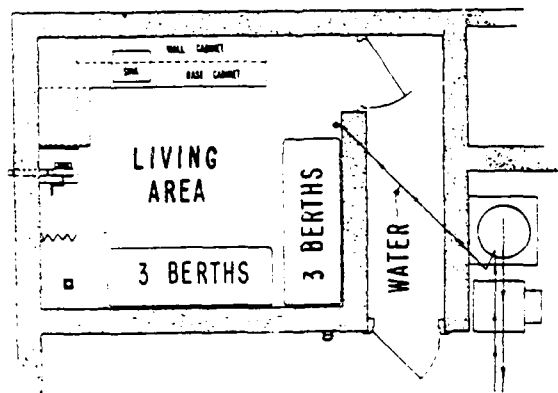
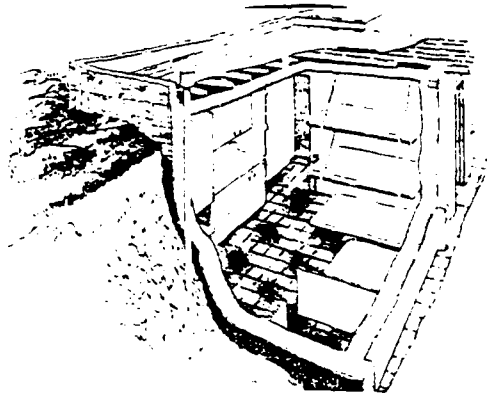
Cresson Kearny of the Oakridge National Laboratories has conducted a number of successful experiments in which families made up of various members have constructed such shelters. Plans for doing this are shown below with a fuller elaboration in the appendix.

To improvise a shelter you would need shielding materials, concrete blocks, bricks, sand, etc. Other things could also be used as shielding material, or to support shielding materials, such as:

- House doors that have been taken off their hinges (especially heavy outside doors).
- Dressers and chest (fill the drawers with sand or earth after they are placed in position, so they won't be too heavy to carry and won't collapse while being carried).
- Trunks, boxes and cartons (fill them with sand or earth after they are placed in position).
- Tables and bookcases.
- Books, magazines, and stacks of firewood or lumber.
- Flagstones from outside walks and patios.

Preplanned Snack Bar Shelter

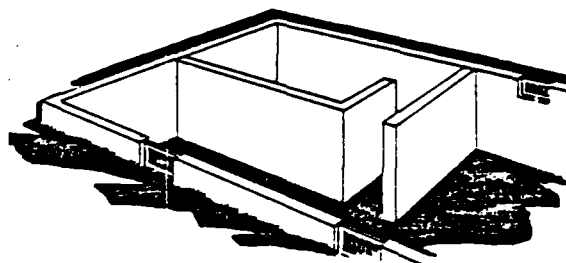




The U.S. Department of Agriculture has developed many shelter plans such as those shown above. These are available through Land-Grant Universities and USDA. The illustration above, and that on the following page, are from Extension Circular No. 330, Utah State University, Logan, Utah 84321.

## EXAMPLE—BASEMENT SHELTER

A family of four elects to build a shelter in their basement. They decide they will sleep in bunks, so the space required is 100 square feet. (Four people times 25 square feet per person).



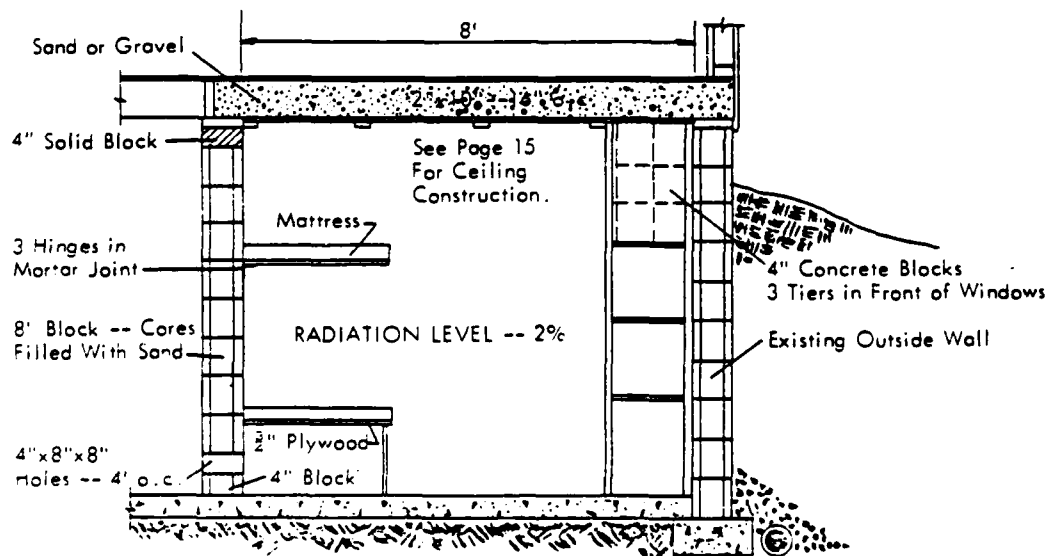
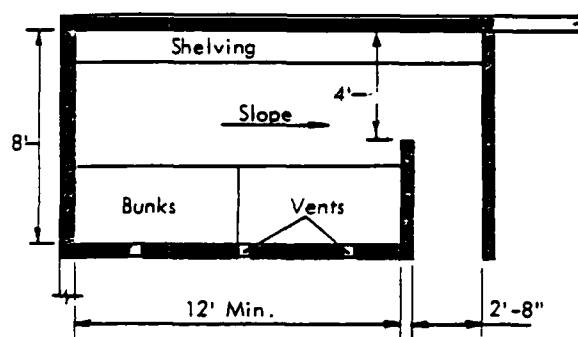
The joists in the house are 2" x 10", 16 inches on center, so a span of up to 8 feet can be used. They decide to fill the space between the joists with sand, so they will get the protection of about 10 inches of sand. This is equal to a material weight of about 85 pounds per square foot. (10 inches weighs about 85 psf)

They decide to provide extra space so that more supplies can be stored within the shelter. They select an 8-foot by 14-foot shelter, which provides 112 square feet.

The drawings on this page show some of the details that can be used for making such a basement shelter.

## NOTE

The radiation level of this particular shelter is 2 percent. The same protection would be obtained if 8 inches of concrete had been substituted for the 10 inches of sand.







Expedient Shelters can be built in a relatively short time away from high risk areas by a few people using simple tools and available materials. Such shelters have been designed and tested by Cresson H. Kearny of the Oak Ridge National Laboratory. Plans for some of these are shown in the Appendix of this handbook. Complete plans are given in Nuclear War Survival Skills, a publication of Oak Ridge National Laboratory (ORNL-5037), 1979.

### Using A Storm Cellar For Fallout Protection

A below ground storm cellar can be used as an improvised fallout shelter, but additional shielding material may be needed to provide adequate protection from fallout radiation.

If the existing roof of the storm cellar is made of wood or other light material, it should be covered with one foot or earth of an equivalent thickness of other shielding material for overhead shielding from fallout. More posts or braces may be needed to support the extra weight.

After the roof has been shielded, better protection can be provided by blocking the entrance way with eight-inch concrete blocks or an equivalent thickness of sandbags, bricks, earth, or other shielding material, after all occupants are inside the shelter. After particles have stopped falling, the outside door may be left open to provide better ventilation.

If shielding material is not available for the entrance way, shelter occupants should stay as far away from it as possible. They also should raise the outside door of the storm cellar now and then to knock off any fallout particles that may have collected on it.

### Shelter Under a House Slab

A shelter can be built by excavating under a small portion of the house slab. First, dig a trench alongside the house, preferably under an eave to help keep out rainwater. Once the bottom of the slab foundation wall is reached, dig out a space under the slab. The area can vary in size, but it should not extend back more than four feet from the outside of edge of the foundation wall. Place support shoring under the slab, and pile dirt on top of the slab (inside the house) over the

shelter area to improve overhead shielding from fallout radiation. You can add to the protection by making a lean-to over the entrance trench, using boards or house doors, covering them with soil, and covering this with a polyethylene sheet to keep out rainwater.

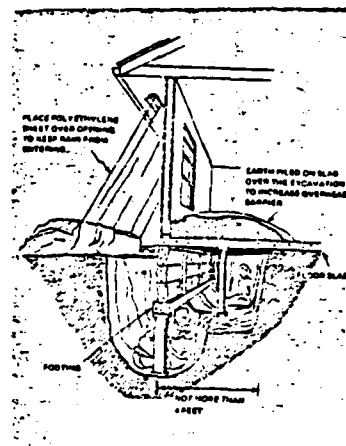
#### Shelters Away From Home

Some people have purchased or built second homes and consider them as Retreats--or vacation homes. These retreats are usually relatively distant from population centers and thus would probably provide protection from a nuclear attack, except for fallout. In addition, most of them have been stocked to make shelter living relatively comfortable. These places must have fallout protection built into them. Many of these are simply mountain homes or cabins in the woods. Their basements are often either lacking or very minimal so far as providing protection. It is quite essential that a retreat not be considered safe until an adequate fallout shelter has been constructed.

There are some other disadvantages to retreats as well. They may be too isolated, providing little possibility of receiving help from others if needed. Also there is the possibility of vandalism which might occur during relatively normal conditions.

A retreat might also be a mobile home or trailer in which people could simply move away from high risk areas. A family could move, possibly building an expedient shelter or simply driving into a tunnel or parking near a cave where they could achieve a high degree of fallout protection.

## Shelter Under a House Slab



### Shelter Requirements

Living in shelters has been successfully done by hundreds of thousands of people during World War II and at other times. Those persons in charge of public shelters will have adequate instructions given them to meet most peoples' needs. Moreover, the shelters have been chosen with considerable care by trained engineers so as to provide for safety.

While the shelters--both public and private--will not be as comfortable as some people would like, they can be safe and livable. They will be more comfortable if those living in them understand the background of decisions that are made concerning livability and safety. In order that shelter residents may understand the kind of issues which are being dealt with by managers, the information given below is presented.

### Radiological Protection

Protection against radiation is the reason for being in the fallout shelter. The requirements and restrictions involved in protecting your family against radiological exposures affect all other decisions that you must make. In sheltering your family and possibly others, your major goals should be to: 1) locate people in the best protected areas of the shelter, 2) keep people in the shelter until outside radiation has decreased to an acceptable level, 3) prevent radioactive particles from entering the shelter in any large quantity, and 4) decontaminate persons or shelters that have radioactive particles on them and remove these particles from the shelter.

The most serious threat from fallout is gamma radiation which is very much like X-rays. Gamma rays are very penetrating and can

penetrate through solid matter to destroy body tissue. Over a period of time the body is able to recover from most of the injuries, providing the individual survives. Nuclear radiation cannot be measured by the human senses but must be detected by radiological devices.

#### How Radiation is Measured

• As previously discussed, gamma radiation exposure is measured in units called "roentgens" (R's). Often the R's are measured in millirems, or one-thousandth of a roentgen. The instrument used to measure the radiation is called a dosimeter. These instruments may be purchased privately and are available to civil defense officials. In most instances, information will be provided about exposure levels on the radio from civil defense officials.

#### Air

A sufficient quantity of air is essential to human life. The need for oxygen to sustain life is well known. Fresh air contains about twenty-one percent (21%) oxygen. No noticeable effects occur should the oxygen content drop to as low as fourteen percent (14%). However, at ten percent (10%) people experience dizziness, deeper and more rapid respiration, and quickened pulse. At seven percent (7%) stupor sets in. At about 5 percent (5%) life begins to fail. However, only a small amount of fresh air is needed to keep the oxygen concentration at a safe level. If each person is allocated 65 cubic feet of volume, according to the civil defense standard, one air exchange in the shelter every two and a half hours should be sufficient to maintain normal health.

A more serious problem is the increase in carbon dioxide concentration. Each person on the average exhales about two-thirds of a

Table B

EFFECTS OF CARBON DIOXIDE* (Oxygen Content Normal)	
Carbon Dioxide Content of Inhaled Air (percent)	Effects
0.04	Normal air, no effects.
2.0	Breathing deeper, volume increased thirty percent.
4.0	Breathing much deeper, rate quickenened, considerable discomfort.
4.5 - 5	Breathing extremely labored, almost unbearable for many, nausea may occur.
7 - 9	Limit of tolerance.
10 - 11	Inability to coordinate, unconsciousness in ten minutes.
15 - 30	Diminished respiration, fall of blood pressure, coma, gradual death after some hours.

Source: Soloma, T., Systematic Action of Gasses--A Manual of Pharmacology, W. B. Saunders Co., Philadelphia, 1948.

cubic foot of carbon dioxide every hour while at rest. If ventilation is inadequate the carbon dioxide can increase markedly over the 0.04 percent present in fresh air. Consequences of higher concentrations of carbon dioxide are shown in Table B.

Experience on submarines and experiments under long exposure have indicated the desirability of keeping the carbon dioxide concentration below one percent (1%). For civil defense purposes the goal has been to limit the build-up of carbon dioxide in shelters to not more than one half percent (.5%) of inhaled air. This limit requires about three cubic feet of fresh air per minute per person. Again if each person is allocated 65 feet of air space, this would require a change of air every 22 minutes. In other words then, the amount of fresh air needed to limit carbon dioxide concentration will also keep the oxygen supply at normal levels.

In order to maintain the normal amounts of oxygen and carbon dioxide, some form of planned ventilation must be utilized. For the most part adequate ventilation can be provided by aiding natural ventilation with manually powered ventilation devices. Natural ventilation occurs because of wind forces and also because warm air tends to rise.

In basements, ventilation is improved if cooler fresh air can be allowed to flow in through a stairway or open windows at one end of the basement while warm shelter air exhausts up another opening. Air pumps can be used to facilitate this flow and to move air from corridors into adjoining rooms.

A simple air pump that can be readily assembled by untrained volunteers, using materials generally available in crisis, has been



developed by C. H. Kearny in the Oak Ridge National Laboratory. The device consists of a frame covered with a wire netting on which overlapping horizontal strips of plastic film are attached at the upper edges to string or wire. Hung in the doorway of a windowless room for example, and set swinging by pulling on a long cord, the plastic flaps press against the frame when swung in one direction pushing air in or out of the room. On the backswing the flaps open so that the air is pumped in only one direction.

Shown in the appendix are instructions for building this kind of pump.

#### Temperature Control

In addition to using oxygen and exhaling carbon dioxide, each shelter occupant gives off heat--about 500 BTU per hour. Part of the heat given off by the body is warmth, as would be measured by a thermometer, and part is water vapor or evaporated moisture. A person's sensation of heat and cold is related not only to the air temperature but also to the amount of moisture contained in the air, or humidity, and the air movement. At higher temperatures the body relies on cooling by perspiration. If the air is humid and air movement is low such cooling loses its effectiveness and the body temperature will rise. The upper limit of the body temperature for survival is 108-110°F. Remember that this is body temperature and not air temperature.

The loss of life in the Black Hole of Calcutta incident was not caused by lack of space but by lack of temperature control. The most widely used measure of the effects of heat and moisture on the human body is effective temperature (E.T.). It combines the effect of air temperature, air moisture, and air movement to yield equal sensations of

## EFFECTS OF HEAT AND HUMIDITY

(for low air movement)

Effective Temperature	Sensation	Reaction	Consequences
50-60	Uncomfortably cold, impairment of circulation	Shivering	Muscular pain
60-70	Cool	Urge for more clothing or exercise	Normal health
70-75	Comfortable	Normal heat regulation	Normal health
75-82	Warm	Regulation by sweating	Normal health
82-85	Uncomfortably hot	Increasing stress and dehydration	Cardio-vascular strain
85-90	Very uncomfortable, Very hot	Increasing Stress	Danger of heat stroke
90-95	Limited tolerance	Failure of regulation, body heating	Circulatory collapse

warmth or cold and approximate equal amounts of heat strain. The effects on people of the temperature and humidity condition represented by E.T. are shown in the table. An effective temperature of 82° approximates the conditions under which federal government workers are sent home from work due to intolerable heat conditions. It is also the limit established by civil defense for shelters.

Even where buildings offering shelter protection are air-conditioned, crowded conditions and the probable lack of electric power indicate that temperature and humidity control must be accomplished by ventilation with fresh air. In shelter living, therefore, it becomes necessary for attention to be given to the problem of ventilation or the conditions necessary for human survival--insufficient oxygen, high carbon dioxide concentration, or high temperature, all will lead to uncomfortable shelter conditions and possibly even sickness or death.

#### Water

Next to good air, water is the most essential requirement in your shelter. Water supply is essential. To assure that each person in the shelter has the minimum amount he or she needs daily, available water may have to be rationed.

Healthy people can survive for quite some time with little or no food, but most of the population will die after four to five days without water. Physical damage to the body caused by lack of water may become irreversible. Each person needs a minimum of approximately 2.2 quarts of water daily or seven gallons for a potential two-week stay.

Your goal is to prevent dehydration of the people in your shelter by providing at least a minimum amount of water needed for drinking. If

possible, you will want to provide water for sanitation, cooking, fire fighting, and washing.

One of the first things you must do is quickly determine how much water will be available in your shelter for a minimum of two weeks occupancy. This will depend on several factors:

- How much water was stored in advance?
- Was the normal water supply for the area functioning, and will it continue to supply at least some of the water during the period when you are in the shelter?
- How much water is available within the piping and storage tanks for the building in which your fallout shelter is located?
- How much water is available which can be used if decontaminated or which can be used for purposes other than drinking or cooking?
- How can you prevent waste and control of water?

Water requirements are another reason to be concerned with air temperature in your shelter. The warmer the temperature, the more people perspire and thus lose water to reduce body heat. If your shelter temperature rises above 82°F the water needed by each person increases rapidly above normal body requirements.

Salty or other thirst-provoking foods may raise water requirements. Foods high in protein and fat greatly increase the amount of water required to emit waste from the body. Vigorous physical exercise also increases water requirements.

### Space

A basic requirement in home shelters is physical space for human occupancy. The approximate volume of the adult human body is 2.3 cubic feet. There are, historically, examples of severe crowding for extended periods of time that have approached this small volume, in slave trade ships, for example. But most confined situations, even prison, offer much greater space per person, as shown in the following table.

In considering the information in the table, it should be noted that the civil defense standard is spacious compared to other particular wartime experiences. This standard is set at ten square feet and 65 cubic feet per person. With these standards it is possible to live reasonably comfortably and safely in confined conditions for extended periods of time.

### Sanitation

The highest possible sanitation standards must be maintained in fallout shelters. The ultimate in sanitation must be sought for in order to prevent and control contagious diseases and for the maintenance of morale. Achieving such standards is very difficult. One of the first steps is to provide instructions in basic hygiene and how to maintain sanitary levels under the crowded, stringent conditions that usually prevail in a shelter. Duties and responsibilities regarding sanitation should be written down and posted in full view. The responsibility must be divided to make sure that clean toilet facilities and areas are established and maintained. Garbage can be collected and disposed of. Supervision of personal hygiene procedures should be carried out particularly in relation to handling food and water.

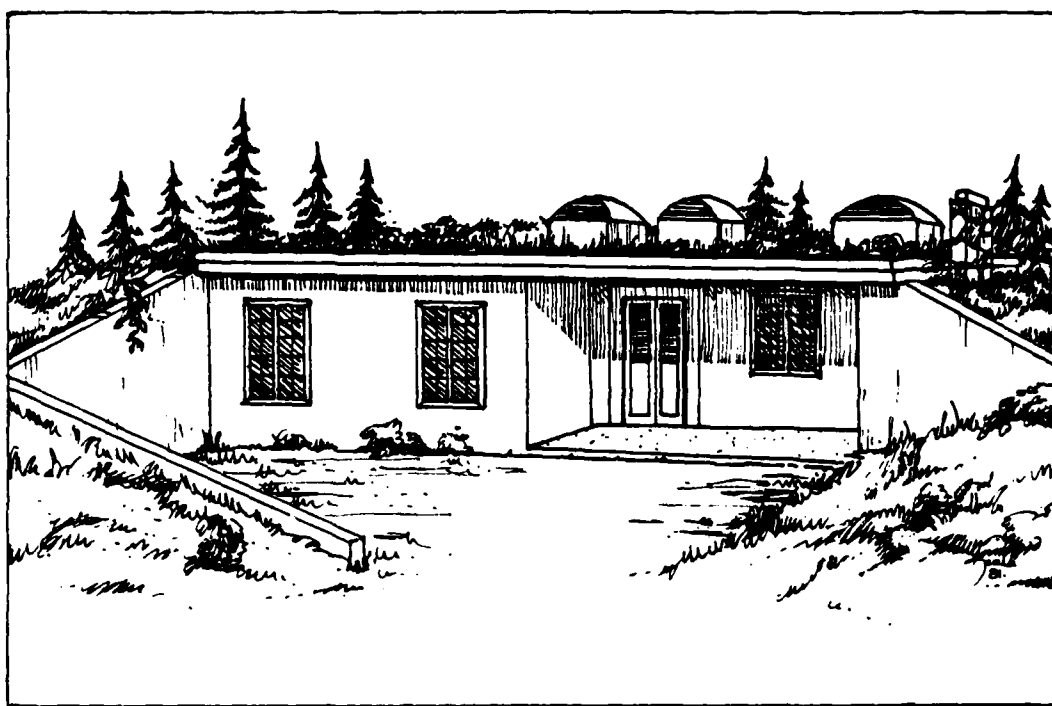
AVAILABLE SPACE IN SELECTED SITUATIONS		
Situation	Area per Person (sq. ft.)	Volume per Person (cu. ft.)
Crowded jail (two men in one-man cell)	19.2	145
Railroad coach (60 seated passengers)	12.0	96
100-person, two-week shelter experiment, NRDL 1959	12.0	117
DCPA Standard	10.0	65
Thirty-person, Two-week Shelter experiment, AIR 1960	8.0	58
Civil War Prison	8.0	40
Local bus filled to seating capacity only	6.3	42
160-person, two-day shelter experiment, U of GA 1966	6.0	60
West German five-day shelter experiment	5.5	--
Swedish recommended shelter minimum	5.4	--
London WWII shelter sleeping 200 people	4.0	30
Belsen Concentration Camp barracks WWII	3.0	22
Black Hole in Calcutta	1.7	22

Shelter Cleanliness

Use chemical disinfectants to clean non-toilet materials.

Containers which are used to collect trash should be placed around the shelter and should be removed regularly to avoid fire, health, and morale hazards. Keep garbage and other waste in tight containers in a separate room, or in the most isolated part of the shelter until they can be removed. Clean up thoroughly after every meal or food distribution. The living area should be inspected regularly for food and garbage that may have been left on the floor.

In killing insects and animals that can spread disease, means other than insecticides and chemicals (especially aerosol sprays) should be used to avoid contamination of the shelter or allergic reactions. Litter cans, dust pans, and garbage boxes can be constructed from cardboard and metal containers. Instruct those in the shelter not to throw away such items as wax paper, empty boxes, and cans which can be used to store garbage.



Houses built partially or totally underground often reduce energy costs more than half, and provide excellent shelter capabilities. An upsurge in the construction of such dwellings has occurred recently.



## Chapter 31

## SUPPLIES

To live in a shelter, people should ideally have a miniature home. Shelter living is a lot like camping. Most people who camp stay for a day or two. In a shelter, however, people must be prepared to camp inside for as long as two weeks or until notified that danger is past. To stay this long requires a considerable amount of food, water, and other supplies. And, the more people there are in the shelter, the more supplies, particularly water and food, are required; and ventilation and space requirements increase.

Whether you move to a public shelter or use a shelter in your own home you will need supplies. This chapter gives instructions for stocking your own shelter. And, since you would be required to bring many of your own supplies with you if you moved to a public shelter, lists of supplies you should take with you are also included.

Stocking a Home Shelter

If you intend to use a home fallout shelter, you should collect all the things you and your family would need for two weeks now, even though you probably will not have to remain inside any shelter that long.

All these items need not be stocked in your home shelter area. They can be stored elsewhere in or around your house, as long as you could find them easily and move them to your shelter area quickly in time of emergency.

### The Absolute Necessities

There are a few things you must have. They are water, food, sanitation supplies, and any special medicines or foods needed by family members such as insulin, heart tablets, dietetic food, and baby food.

### The Complete List

In addition to the absolute necessities, there are other important items. Some of them may be needed to save lives. At the least they will be helpful to you. Here is a list of all major items--both essential and desirable.

Water. This is even more important than food. Each person will need at least two quarts of water per day. Some will need more. Store water in plastic containers, or in bottles or cans. All containers should have tight stoppers. Part of your water supply might be "trapped" water in the pipes of your home plumbing system and part of it might be in the form of bottled or canned beverages, fruit or vegetable juices or milk. A water-purifying agent (either water-purifying tablets, two percent tincture of iodine or a liquid chlorine household bleach) should also be stored in case you need to purify any cloudy or "suspicious" water that may contain bacteria.

The following are typical examples of the capabilities different types of buildings have for storage of potable water, that is water that can be used for drinking and cooking as well as other purposes. These sources should not be overlooked. One of the first things you should do is to cut off the supply of water from the outside if there is any danger of its being contaminated. Otherwise, the water may be drained from the piping and tanks of the home. Later if it is found that the

drinking water in the culinary system is safe and adequate for use then your valve could be turned on so that you might have it.

Single Unit Dwelling

Hot water storage tank - 30 to 40 gallons  
Water closet flush tank - 4 gallons each  
Water piping - 1.5 to 2 gallons

Multi-Unit Dwelling (Apartment Building)

Hot water storage tank - 10 to 20 gallons per apt.  
Water closet flush tank - 4 gallons each  
Water piping - 1 gallon per apt.

How to Distribute Water. Do not attempt to limit the amount of water drunk, but distribute water for drinking only at specific times. How you arrange this depends on the size of the group in the shelter and what water resources are available. Your population needs to drink water at regular intervals throughout the day at least five times. Do not serve water in glasses as broken glass is a hazard in crowded situations. Each person should use a metal or plastic cup and should put his name or initials on it and store it where it will be easy to use.

How to Purify Water. Water that is not from the regular water supply system may be contaminated. The three most probable impurities are: 1) bacteria, 2) foreign bodies, and 3) such toxics as anti-rust chemicals.

To purify against bacteria water purification tablets may be used or several drops of chlorine household bleach or tincture of iodine may be added to each quart of water. Water boiled for at least one minute will also be purified against bacteria. You may wish to conserve the fuel and not add heat to the temperature level of your shelter. To purify against foreign bodies, water may be filtered through filter

paper, gauze, or finely woven fabric; or allow water to stand until the sediment settles and then pour off the clean water.

Water from the building's heating and cooling systems may have been treated chemically to prevent rust, scale and so on. This water will not be usable for drinking purposes unless you can determine its safety. Its use can be for sanitation purposes and fire fighting.

How to Improve the Taste of Stored Water. Drinkable water that has been stored in a closed system or container for any length of time may taste bad and appear undrinkable to many people. Exposing it to fresh air will improve its taste. Carefully pour it from one container to another several times to give it air exposure.

Further information on water is covered in Chapter 7, "Water."

Food. Enough food should be kept on hand to feed all shelter occupants for fourteen days, including special foods needed by infants, elderly persons and those on limited diets. Most people in shelters can get along on about half as much food as usual and can survive without any food if necessary. If possible, store canned or sealed packaged foods, preferably those not requiring refrigeration or cooking. These should be replaced periodically. For types of food suitable for storage, and suggested replacement periods, refer to Chapter 3, "Food."

Sanitation Supplies. Since you may not be able to use your regular bathroom during a period of emergency, you should keep on hand these sanitation supplies: A metal container with a tight-fitting lid to use as an emergency toilet, one or two large garbage cans with covers (for human wastes and garbage), plastic bags to line the toilet container, toilet paper, wash cloths and towels, clean rags, a pail or basin,

disinfectant, waterproof gloves, sanitary napkins or tampons, and disposable diapers, if needed.

Toilet Facilities. Ordinarily the toilet facilities in the building could be used. The brief radioactive exposure that might be encountered while toilet facilities are used would ordinarily not pose a serious health hazard. If such facilities cannot be used, then toilet areas should be located away from the living areas and the food- and water-handling areas. Toilet areas should if possible, be near ventilation exhausts. These temporary toilet areas should be shielded from view behind improvised partitions. To construct collapsible toilets, such as those made for camping trips, water containers with snug fitting lids which are lined with plastic bags may be used; for example, covered garbage can pails or buckets.

In each improvised toilet area there should be larger containers into which the smaller ones can be emptied after each use. A supply of disinfectant or chemicals such as chlorine or bleach, which can be sprinkled into the toilets after each use to control odor and germs, should be maintained. If possible, move filled container to a separate room or to the most isolated section of the shelter until it can be moved outside. Do NOT remove filled plastic bags from the drums, garbage cans or pails unless absolutely necessary. If it is necessary to move them, slide them across the floor.

To increase toilet area cleanliness it is desirable for both men and women to perform all toilet functions sitting down. Adults should accompany children for assistance even if the child is toilet trained. Diapers should be made available or they can be improvised to clean up after small children. It may be necessary to schedule toilet use. You

must remember that any illness which causes diarrhea or vomiting will increase toilet use. It is urgent that toilet facilities be kept very clean at all times.

An emergency toilet, consisting of a watertight container with a snug-fitting cover, would be necessary. It could be a garbage container or a pail or bucket. If the container is small a larger container, also with a cover, should be available to empty the contents into for later disposal. If possible both containers should be lined with plastic bags.

This emergency toilet could be fitted with some kind of seat especially designed for children or elderly persons. Or it may be possible to remove the seat from a wooden chair, cut a hole in it and place the container underneath. For privacy the toilet should be screened from view.

Every time someone uses the toilet he should pour or sprinkle into it a small amount of regular household disinfectant such as creosol or chlorine bleach to keep down odors and germs. After each use the lid should be put back on.

When the toilet container needs to be emptied, and outside radiation levels permit, the contents should be buried outside in a hole one or two feet deep. This would prevent the spread of disease by rats and insects.

If the regular toilets inside the home--or the sewer lines--are not usable for any reason, an outside toilet should be built when it is safe to do so.

If anyone has been outside and fallout particles have collected on his shoes or clothing, they should be brushed off before he enters the shelter again.

Medicines and First Aid Supplies. This should include any medicines being regularly taken or likely to be needed by family members. First aid supplies should include all those found in a good first aid kit (bandages, antiseptics, etc.), plus all the items normally kept in a well-stocked home medicine chest (aspirin, thermometer, baking soda, petroleum jelly, etc.) A good first aid handbook is also recommended.

Sleeping Supplies. Blankets are the most important items of bedding that would be needed in a shelter, but occupants probably would be more comfortable if they also had available pillows, sheets, and air mattresses or sleeping bags. You will likely not be able to provide beds, cots or other conventional furniture to your entire population. Even if such equipment were available it would probably not be useful in the shelter because it would take up so much space. The people in the shelter could sleep on a bare concrete floor, but it would not be very comfortable. You can increase comfort considerably by using blankets, rugs, or cardboard box material in making sleeping pads about six feet by two feet wide. Air mattresses could be used, but they tend to take up more space than sleeping arrangements would allow in most small shelters, but if there is enough space they make excellent improvised beds.

Bunks can be constructed from book cases or shelves. Support six-foot by two-foot pieces of plywood or press board with the book

cases at each end. These bunks can be taken apart during the day to provide more space in the shelter.

Fire Fighting Equipment. Simple fire fighting tools and knowledge of how to use them may be very useful. A hand-pumped fire extinguisher of the inexpensive, five-gallon water type is preferred. Carbon tetrachloride and other vaporizing liquid type extinguishers are not recommended for use in small enclosed spaces because of the danger of fumes. Other useful fire equipment for home use includes buckets filled with sand, a ladder and a garden hose.

Infant Supplies. Families with babies should keep on hand a two-week stock of infant supplies such as canned milk or baby formula, disposable diapers, bottles and nipples, rubber sheeting, blankets and baby clothing. Because water for washing might be limited, baby clothing and bedding should be stored in larger-than-normal quantities.

Cooking and Eating Utensils. Emergency supplies should include pots, pans, knives, forks, spoons, plates, cups, napkins, paper towels, measuring cup, bottle opener, can opener and pocket knife. If possible disposable items should be stored. A heat source also might be helpful, such as an electric hot plate (for use if power is available) or a camp stove or canned-heat stove (in case power is shut off). However, if a stove is used indoors adequate ventilation is needed.

Clothing. Several changes of clean clothing--especially undergarments and socks or stockings--should be ready for shelter use in case water for washing should be scarce.

Power and Light. The amount of electrical power available for fallout shelters will probably be limited. Moreover, you can expect instructions to keep the electrical power demands as low as possible to



conserve fuel. During the time of threat from nuclear detonation or from fallout, it will be not be possible to send out repair crews to replace downed lines or make other repairs. It would be most helpful if a portable generator were available to provide a limited amount of electricity. In lieu of this, however, other means of light and power will have to do. In using whatever means of power that is available in your shelter, you should use the following survival-related remedies:

1. Ventilation
2. Water supply (if electrical pumps are involved)
3. Emergency equipment and essential lighting circuit
4. Heating systems, in very cold weather
5. Refrigeration units, for storage of perishable foods.

Characteristics of Fluorescent Lighting. There is little or no glare from this type of fixture. Light is fairly evenly distributed and produces only one-fourth as much heat as do incandescent light bulbs, giving the same amount of light. If you have alternatives, therefore, choose fluorescent lighting reducing the temperature in the shelter. The coating of fluorescent tubes contains substances which can be harmful if they are broken and enter the body through cuts. If fluorescent lighting breaks the pieces should be picked up carefully and disposed of immediately.

Characteristics of Incandescent Lighting. These are more reliable than fluorescent, especially if there is some damage to the commercial or auxiliary power supply resulting in frequent voltage dips. In addition, incandescent lighting can provide heat, if that is necessary, for shelters under cold conditions. The best emergency lighting is from emergency generators in your building.

General Equipment and Tools. The essential items in this category are a battery-powered radio and a flashlight or lantern with spare

batteries. The radio might be your only link with the outside world and you might have to depend on it for all your information and instructions especially for advice on when to leave shelter. Include writing materials for taking notes on information given over the radio. Other useful items: a shovel, broom, axe, crowbar, kerosene lantern, short rubber hose for siphoning, coil of half-inch rope at least 25 feet long, coil of wire, hammer, pliers, screwdriver, wrench, nails and screws, work gloves.

Miscellaneous Items. In addition to such practical items as matches, candles and civil defense instructions, some personal convenience items could be brought into the home shelter if space permits. These might include books and magazines, a clock, calendar, playing cards, hobby materials, a sewing kit and toiletries such as toothbrushes, cosmetics and shaving supplies.

#### What to Take with You to Move into a Public Shelter

To augment the supplies of water and food normally found in or near large structures where public fallout shelter is usually located, plan to take the following necessities with you:

- Special medicines or foods required by members of your family, such as insulin, heart tablets, dietetic food, or baby food.
- A blanket for each family member.
- A battery-powered radio, flashlight, extra batteries for each and writing materials for taking notes or information given over the radio.

--As much potable liquids (water, fruit and vegetable juices, etc.) and ready-to-eat food as you can carry to the shelter.

Given below is a complete list of all items that you should take with you in relocating to a safer area. Take all of these items if you are using your car. If using public transportation take only those items marked with an X.

Clothing or Bedding

☐ X work clothes

☐ X rain garments

☐ X work clothes

☐ X extra pair of shoes

☐ X extra underclothing

☐ X sleeping bags and/or

☐ X outerware (depending on season)

☐ X blankets and sheets

Personal, Safety, Sanitation and  
Medical Supplies

☐ X battery operated (transistor)  
radios, extra batteries

☐ X flashlight, extra batteries

☐ X soap

☐ X sanitary napkins

☐ X shaving articles

☐ X detergent

☐ X towels and washcloths

☐ toilet paper

☐ emergency toilet

☐ garbage can

☐ newspapers

☐ first aid kit

☐ X special medication  
(insulin, heart tablets,  
or other)

☐ X toothbrush and  
toothpaste

Baby Supplies

☐ X diapers

☐ X bottles and nipples

☐ X milk or formula

☐ X powder

☐ X rubber sheeting, etc.

### Tools for Constructing a Fallout Shelter

☐ pick axe

☐ axe

☐ shovel

☐ crowbar

☐ saw

☐ nails and screws

☐ hammer

☐ screwdriver

☐ broom

☐ wrench

### Important Papers

☒ X Social Security Card

☒ X Will

☒ X Deeds

☒ X Savings Accounts Books

☒ X Insurance Policies

☐ Credit Cards and Currency

☐ Stocks and Bonds

Shelters are important in protecting people from a nuclear attack. This is true whether persons are far from the detonation and subject only to the risk of fallout, or nearby where all hazards threaten. Shelters must do more than shield people from life-threatening effects, however. They must provide a habitable environment from which survivors can emerge in good condition to deal with the post-emergency world. If people are to use shelters effectively, they must know enough about shelters to make them liveable. If shelters are not liveable, people will not use them. Some of the conditions affecting liveability in shelters are the result of physical characteristics. Some are due to the behavior of people. These physical and behavioral aspects are closely related.

Fortunately much shelter experience from the past is available to provide guidance. But, relatively few Americans have lived in shelters. Therefore, one of the first questions asked by Americans when faced with the possibility of using a shelter is whether living in a shelter for a period as long as two weeks is possible. The answer obtained from both war experience and planned experiments results in an emphatic, "Yes!" In fact, most volunteers who have participated in experiments actually enjoyed it and said they would volunteer again; and many who were sheltered in wartime are alive because of it.

During the past fifteen years some shelter-living experiments have been made so austere and uncomfortable that a significant proportion of volunteers decided to leave during the experiment. Yet these difficult, Spartan-like experiences have clearly demonstrated that people can exist

in shelters, in closely confined situations, lacking most of the comforts of life and still maintain a healthy and reasonably normal environment.

Information which "shelter managers"--persons who have ultimate authority to operate shelters--and others sharing responsibility for working and living in them should know are given in this chapter. This critical knowledge, almost taken for granted in normal life, becomes vital to maintaining health and well-being in shelters. They include considerations of space, air, temperature control, water, sanitation, sleep, health, food, and lighting.

#### Managing Your Home Shelter

An emergency is a threatening situation that occurs not of our own choosing. Preferences as to the nature of the emergency, the time and the place are neither chosen nor selected. Emergencies are thrust upon us. People ordinarily choose not to have emergencies. A nuclear emergency, by its nature, is possibly life- and property-threatening. A nuclear emergency can be very limited in its scope, such as an accident in a laboratory. Or a nuclear emergency can be larger in scope, such as a nuclear power plant failure. The biggest nuclear threat, though, is that pertaining to nuclear intimidation or, worse, a nuclear war. In order to preserve your life and that of others close to you, families and individuals must accept major responsibility for survival.

Members of families, or individuals comprising a household have a great advantage over other organizations in that they are already organized. Usually there is a head of the household, often the father or mother. Secondly, there are children and others living in the home. Past experience with one another has likely resulted in a division of

tasks that have to be performed. There is usually one person who is an accepted leader, whether it be mother, father, or unrelated person, who decides what is done. This division of responsibility and the various tasks that go with those responsibilities provide a workable organization for living in a home shelter.

In managing a shelter each person should be given one or more duties to perform. Someone in the family should act as the shelter manager, and all others should assist him in various ways. The shelter manager should have the ability to (1) manage the family, (2) wisely make use of available resources, (3) function effectively under stress. Experience has shown that the persons who best serve as a shelter manager are mature, middle-aged persons who are in good physical health. Ideally this person should have had experience in managing others, preferably in a stressful situation, such as military combat, mountain climbing, cave exploring, auto racing, or some other demanding circumstance. For most people, however, managing a family successfully through its normal stresses and strains provides suitable experience to manage a family home fallout shelter.

First Priority. When establishing a shelter in time of emergency, there are certain tasks that the shelter manager should perform which have greater priority than others. One of these high priority actions requires the shelter manager appoint others to do special tasks. In addition to the shelter manager, there are four other major areas of responsibility to which people ought to be appointed, if available. If there are not sufficient people to divide up these four major tasks one person may take two or more of these. The major areas of management are



- 1) administration, 2) operational services, 3) technical services, and
- 4) special services.

Second Priority. The second priority for the shelter manager is to assign the available space in the shelter to various members, and to organize them into smaller groups if there are more than six people in the shelter.

Third Priority. The third high priority task for shelter managers is to establish procedures for security and fire prevention.

Fourth Priority. Fourth is to establish and maintain a constant air exchange, bringing fresh air in and exhausted stale air and odors out.

Fifth Priority. A fifth priority is to establish and maintain communications with civil defense officials and to monitor radio and television for news bulletins.

Sixth Priority. The sixth action is to test and maintain in good working order all electric equipment.

Seventh Priority. Seventh is to set up toilets as needed.

Eighth Priority. Eighth is to check cleanliness and adequacy of water supplies and locate additional sources of water.

Ninth Priority. Ninth is to establish medical care and begin screening members of the family for illness.

Tenth Priority. Tenth is to determine how the family will be fed.

Eleventh Priority. The eleventh high priority task is to check the inventory of immediately available supplies.

A list of things of lower priority tasks needed to be done by the managers follows:

1. Establish a daily schedule. (See tables A and B)
2. Maintain a daily supply inventory and a medical care program.
3. If the situation appears threatening, the shelter could be upgraded to provide fallout protection, if it does not already have that capability.
4. Obtain readings from officials so that radioactive levels might be measured within your own shelter.
5. Complete the assignment of work and organization and begin daily information meetings.
6. Establish the special service groups and begin psychological support.
7. Obtain additional sanitary supplies and other equipment for making life more comfortable in the shelter.

Another major set of tasks lies under the heading of operational services. The person assigned to perform these tasks has the obligation of making sure that food is available and that water sanitation facilities are established, that medical care and supplies are available, and that sleep is monitored so that people get enough sleep. This person would also help in maintaining order.

Under the technical services responsibility a person would be assigned to maintain communication through the radio or television, particularly with civil defense and governmental officials, and to inform those in the shelter of communications. In particular, attention would be given to getting information in the radiological conditions and protection advice for families to follow. In addition, this person

TABLE A

## Sample Daily Schedule

## A.M.

7:00	Wake up
7:30	Breakfast
8:30	Clean up
9:00	Sick call
9:30	Training session, or group meeting, or continuation of sick call, or recreation
10:00	Coffee break (if water supply is adequate)
10:30	Training session
11:00	Training session. Ongoing education for children
11:30	Free time for quiet activities
NOON	Lunch

## P.M.

1:00	Clean up
1:30	Information and training session
	Nap for children
2:00	Information and training session
	Ongoing education for children
2:30	Emergency drills
3:00	Coffee break (if water supply is adequate)
3:30	Recreational activities
4:00	Recreational activities
4:30	Free time for quiet activities
5:00	Dinner
6:00	Clean up
6:30	Daily briefing
7:00	Training session
7:30	Planned recreational activities
8:00	Planned recreational activities
8:30	Free time for quiet activities
9:00	Free time for quiet activities
9:30	Coffee break (if water supply is adequate)
10:00	Free time for quiet activities
10:30	Prepare for sleep
11:00	Lights out

## NOTE

If water is being rationed, you will have to include water distribution, washing, and similar times in your schedule. Also, if food is rationed, you may wish to schedule more frequent, smaller meals, for morale purposes.

**TABLE B**  
Sample Daily Schedule for Two Shifts

SHIFT A	Time	SHIFT B
	A.M.	
Wake up	7:00	Recreation
Breakfast	7:30	Recreation
	8:00	Free time for quiet activities
Clean up	8:30	Prepare for sleep
Sick call	9:00	Sleep
Group meeting or sick call	9:30	
Coffee break (if water supply is adequate)	10:00	
Training session	10:30	
Training session	11:00	
Free time for quiet activities	11:30	
Lunch	NOON	
	P.M.	
Clean up	1:00	
Training session	1:30	
Training session	2:00	
Coffee break (if water supply is adequate)	2:30	Wake up Breakfast  Clean up Sick Call Briefing Training session Emergency drills  Coffee break (if water supply is adequate) Free time for quiet activities Lunch  Clean up Training session  Training session Coffee break (if water supply is adequate) Quiet recreation Quiet recreation Free time for quiet activities Dinner  Clean up Free time Recreation Recreation Briefing Training session Emergency drills Coffee break (if water supply is adequate)  Free time for quiet activities Free time for quiet activities Prepare for sleep Sleep
Quiet recreation	3:00	
Quiet recreation	3:30	
Free time	4:00	
Dinner	4:30	
	5:00	
Clean up	5:30	
Free time	6:00	
Recreation	6:30	
Recreation	7:00	
Briefing	7:30	
Training session	8:00	
Emergency drills	8:30	
Coffee break (if water supply is adequate)	9:00	
Free time for quiet activities	9:30	
Free time for quiet activities	10:00	
Prepare for sleep	10:30	
Sleep	11:00	
	11:30	
	Midnight	Training session
	A.M. 12:30	Coffee break (if water supply is adequate)
	1:00	Quiet recreation
	1:30	Quiet recreation
	2:00	Free time for quiet activities
	2:30	Dinner
	3:00	
	3:30	Clean up
	4:00	Training session
	4:30	Training session
	5:00	Free time for quiet activities
	5:30	Free time for quiet activities
	6:00	Group meeting
	6:30	Coffee break (if water supply is adequate)

should have responsibility for the maintenance of ventilation, supply of power and lights, of developing a means of controlling and preventing fires, and of up-grading the shelter, so as to be even further protected from fallout.

Another area of assignment can be categorized as special services. This category includes giving psychological support to one another to keep morale up and to provide religious support as well. In addition, recreation should be engaged in along with training and education to perform more effectively, efficiently, and cooperatively in a shelter environment.

#### Home Shelter Management - Other Than Family Members

With more people in the shelter, particularly those unrelated to the family, it is recommended that the shelter management responsibilities remain with the owners of the home and the family itself. Others should come in the traditional role of guest. This does not mean, however, that those who are being sheltered, other than the immediate family, should be waited upon without any sort of reciprocal action. On the contrary, it is highly desirable that they be assigned tasks that need to be performed in the shelter, recognizing that the head of the household in whose home they are living will likely be the shelter manager. It would be entirely appropriate for an assistant manager to be designated from each family that moves into the shelter. In this way full use can be made of those people. They will have satisfaction of knowing that they are making a positive contribution and an exchange of ideas and a feeling of belonging will be enhanced.

The greater the number of people that are in a shelter the more regimented shelter life must be in order to meet the needs of all people

and protect the safety of them. In a crowded shelter a two-shift schedule may be adopted.

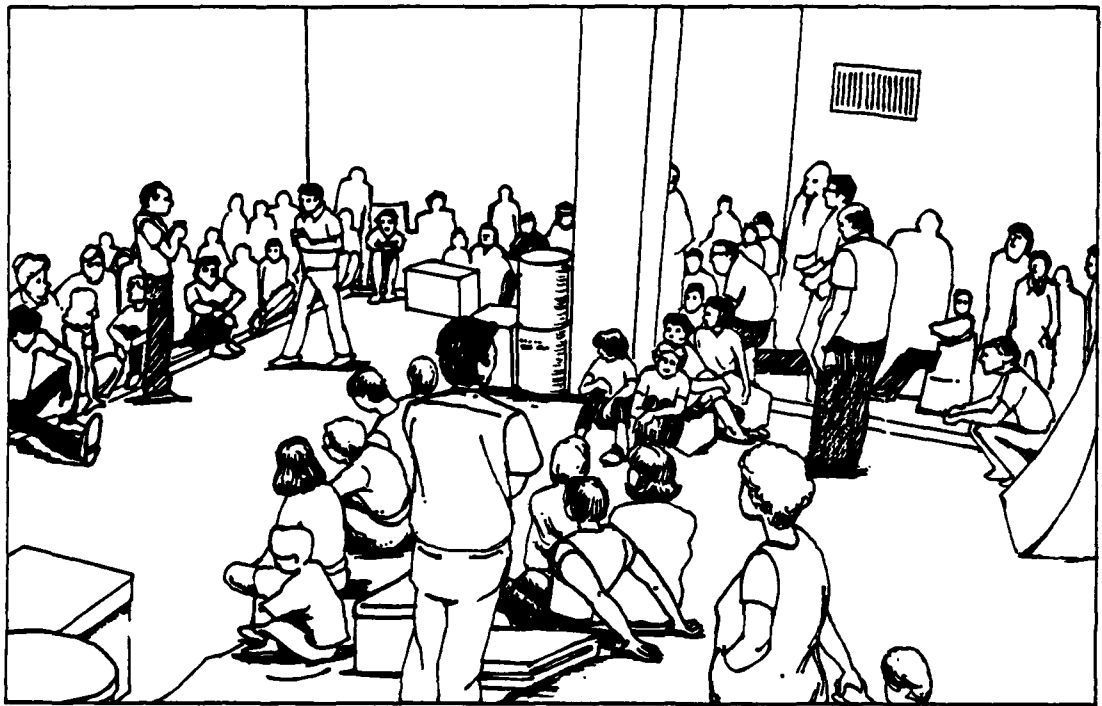
There will have to be scheduled quiet times to allow for the development of calm and tranquility which comes from living under stressful situations. The religious and psychological support services will need to be incorporated as well as a regular sick call which will need to be made for those who may suffer real or imagined illness.

#### Shelter Management of Public Shelters

In public shelters, the management of the shelter will be done by those appointed by local civil defense officials where trained shelter managers exist. Where no trained shelter managers exist, someone with leadership ability will have to take charge. It will be necessary that those who participate in public shelters follow the instructions given them by shelter managers and carry out all assignments given them. Some of these assignments may not be to their liking but if all of those participate and cooperate, their safety and comfort will be assured so far as possible. The managers of public shelters will have an official status to maintain order, discipline, to allocate supplies, and to make assignments as necessary. They will be backed in their decisions by local public safety officers and others.

#### Water, Food and Sanitation

At all times and under all conditions, human beings must have sufficient water, adequate food and proper sanitation in order to stay alive and healthy. Living in a shelter--even for a week or two--may make water and food scarce. And it is difficult to maintain normal sanitary conditions. Water and food supplies would have to be



"managed"--that is, kept clean, and used carefully by each person in the shelter. Sanitation also would have to be managed and controlled, perhaps by setting up emergency toilets and other facilities, and rules to insure that they are used properly.

In a home shelter, you and your family will be largely on your own. You would have to take care of yourselves, solve your own problems, make your own living arrangements, subsist on the supplies you had previously stocked, and find out for yourself (probably by listening to the radio) when it was safe to leave shelter. In this situation, one of your most important tasks would be to manage your water and food supplies, and maintain sanitation.

Care and Use of Water Supplies. (See also Chapter 7, "Water")

Each person's need for drinking water will vary, depending upon age, physical condition, and time of year. The average person under usual or normal conditions in a shelter would need at least two quarts of water or other liquids to drink per day, but more would be useful. Each person should be allowed to drink according to need. Under no circumstances should drinking water be rationed to make it last a certain length of time. Studies have shown that nothing is to be gained by limiting drinking water below the amount demanded by the human body. Even with a limited supply it is safer to drink it as needed in the hope that the supply can be replaced if your shelter stay should warrant it.

In addition to water that may be stored in containers, there is usually other water available in most homes that is drinkable, such as

- Water and other liquids normally found in the kitchen, including ice cubes, milk, soft drinks, and fruit and vegetable juices.
- Water (20 to 60 gallons) in the hot water tank.



--Water in the flush tanks (not the bowls) of home toilets.

--Water in the pipes of your home plumbing system. In a time of nuclear attack, local authorities may instruct householders to turn off the main water valves in their homes to avoid having water drain away in case of a break and loss of pressure in the water mains. With the main valve in your house closed, all the pipes in the house would still be full of water. To use this water, turn on the faucet that is located at the highest point in your house, to let air into the system; and then draw water, as needed, from the faucet that is located at the lowest point in your house.

In a home shelter, occupants should drink first the water they know is uncontaminated, such as that mentioned above. Of course, if local authorities tell you the regular water is drinkable, it should be used.

If necessary, "suspicious" water such as cloudy water from regular faucets or perhaps some muddy water from a nearby stream or pond-can be used after it has been purified. This is how to purify it:

1. Strain the water through a paper towel or several thicknesses of clean cloth, to remove dirt and fallout particles, if any. Or else let the water "settle" in a container for 24 hours, by which time most solid particles probably would have sunk to the bottom.

2. After the solid particles have been removed, boil the water if possible for 3 to 5 minutes, or add a water-purifying agent to it. This could be either: (a) water-purifying tablets, available at drug stores, or (b) two percent tincture of iodine, or (c) liquid chlorine household bleach, provided the label says that it contains hypochlorite as its only active ingredient. For each gallon of water, use 4 water-purifying

tablets, or 8 drops of tincture of iodine, or 8 drops of liquid chlorine bleach. If the water is cloudy, these amounts should be doubled.

There would not be much danger of drinking radioactive particles in water, as most would sink quickly to the bottom of the container or stream. Very few would dissolve in the water. Although open reservoirs might contain some radioactive iodine in the first few days after an attack, this danger is considered minor except to very young children.

Care and Use of Food Supplies. (See also Chapter 3, "Food.") Food also should be rationed carefully in home shelter, to make it last for at least a two-week period of shelter occupancy. Usually, half the normal intake would be adequate, except for growing children or pregnant women.

In a shelter, it is especially important to be sanitary in the storing, handling and eating of food, so as to avoid digestive upsets or other more serious illness, and to avoid attracting vermin. Be sure to:

- Keep all food in covered containers.
- Keep cooking and eating utensils clean.
- Keep all garbage in a closed container, or dispose of it outside the home when it is safe to go outside. If possible, bury it. Avoid letting garbage or trash accumulate inside the shelter, both for fire and sanitation reasons.

In many home shelters, people would have to use emergency toilets until it was safe to leave shelter for brief periods of time.

#### How To Determine Arrival of Fallout

If radio communication is not established and you lack a dosimeter or if there is no other protection available, use the following rough measures:

Place a white plate or a white cloth in an exposed area outside the shelter door, during the day. Fallout will be visible as it falls. A flashlight beam will illuminate fallout as it descends at night. You cannot detect radiation without monitoring instruments or communication with officials, however.

How to Decontaminate Persons, Objects, Areas. (See also Chapter 38). Most in-shelter decontamination can be done with brooms and cloths by following the simple procedures given below.

Decontaminating People.--Persons entering the shelter after fallout has begun to descend should be visually inspected for particles. Use combs and brushes to remove particles or brush them off with your hands. Then sweep the small amount of fallout out of the shelter and the home as well. Brush, wipe thoroughly or wash contaminated portions of skin and hair.

Decontaminating Areas.--Small amounts of fallout penetrating a shelter opening can be swept out like sand. Attempting to remove considerable amounts of fallout from a larger area may result in considerable exposure to persons doing so. Unless there is an immediate and important need for the contaminated space, it is better to isolate the material using high density materials such as concrete, bricks, sand, stacks of books or other things.

Decontaminating Food and Water.--Food and water stocked in the shelter requires no decontamination. Fallout particles on other foods should be removed as one removes sand from the beach. Serve uncontaminated food first. Afterward, if your family is hungry, serve the contaminated food after decontaminating as thoroughly as possible.

Serve uncontaminated water first, if available. Then serve water, if drinkable from a medical standpoint, even though it may contain some radioactive particles.

To decontaminate water, as mentioned, filter water through paper towels or layers of fine cloth, or allow it to stand until the sedimentation settles to the bottom. Then siphon off the relatively uncontaminated upper layer. Then get rid of the fallout from the shelter. REMEMBER--water is vital for survival. Do not deny population water unnecessarily in the name of radiologic protection.

Lighting and Power (See also Chapter 4, "Light and Heat")

In most shelters emergency lighting would have to be provided. This would be through batteries, power devices such as flashlights, gas operated lanterns, or other emergency lamps.

Relative to gas-operated lanterns it should be noted that they generate considerable heat as well as light, and also use oxygen at relatively high levels. Therefore, good circulation must be maintained to use these effectively.

In relation to managing your family shelter regarding light and power your goals should be to:

1. Insure as many auxiliary lighting devices as possible are brought into the shelter prior to the emergency or soon afterward.
2. Control use of emergency power and lighting in the event that normal power is not available.
3. Evaluate the importance of illumination in establishing locations for different areas.

### Controlling Illumination Levels

This won't be a problem if there is little or no electrical power and you have to use portable lanterns and/or candles to provide light. If, however, you are using limited outside power sources or portable generators you can control the amount of light used in different areas by:

1. Using differential switching, where separate switches control different lights and they are on different circuits.
2. Disconnecting certain fixtures and circuits by loosening lightbulbs in the sockets.

### The Importance of Maintaining the Day/Night Cycle

The day/night cycle is important in organizing your shelter and in maintaining morale. The cycle helps to maintain the concept of passage of time in days and thus provides managing of the length of time your family and others may be confined in a shelter area without natural daylight.

### Fire Prevention and Control (See also Chapter 37)

Fire is a major safety threat to living in fallout shelter because of crowded fallout shelter conditions, the probable lack of sufficient water for fire-fighting purposes, the unavailability of help from the local fire department during the time of greatest fallout, and the fact that evacuating the shelter may be dangerous. Because of radioactivity outside, all these factors combine to make fire a major threat to the safety of those in the shelter. Fire prevention, therefore, is of paramount importance.

The ability to detect an outbreak of fire and to control it as quickly as possible is the principal means of eliminating this threat. In fact, the best defense against fire is to not let it happen at all. Therefore, there must be a 24-hour fire watch. An individual should monitor possible threats such as temperature and circulation as part of the shelter program. The population must know how to fight fire quickly and actively. Daily firedrills and instructions would be well worth the time and effort. Smoking must be tightly controlled, if permitted at all. The goals regarding fire in the shelter are to:

- 1) prevent the outbreak of fire in the shelter.
- 2) detect, confine, control and extinguish the fire, if it occurs.
- 3) train the persons in the shelter in fire prevention and fire-fighting.
- 4) conduct emergency fire drills if there is space. (If there is not space for such drills, oral instruction for fire drill procedures should be given.)

Why Fire Instructions and Drills are Recommended. Fire spreads quickly. In moderate wind, fire doubles in volume every three to seven minutes after initial flash over (the period of rapid growth of the fire, when the whole room appears to burst into flame).

The population of an average residential basement has only ten minutes to escape safely from an overhead fire that is out of control. In a fallout shelter the problem is made worse because of the limitations on possible escape routes and the number of people involved in the crowded conditions. Even though your home may be fire-resistant and have modern fire-fighting equipment, automatic fire-fighting devices

are not fool-proof, and the combustible contents of a fire-resistant building can burn, often violently. Sprinkler and hose systems requiring water supplies may not function at all if the pressure is low or the water is cut off.

How Fires are Caused and Spread. Fires can be caused directly or indirectly by nuclear weapons, or they can be unrelated to weapons effect and be caused by heat-producing devices: smoking, flammable items, or spontaneous combustion.

There are three ways in which fire can spread:

- 1) convection.--A short-range spread from one building to an adjacent building, or among buildings sharing common walls. In convection, direct flames or hot gases of an active fire heat up nearby combustibles until they are sustained ignition.
- 2) radiation.--(Unconnected with fallout.) The flaming mass of a burning building radiates heat which, in sufficient quantity, raises the temperature of exposed elements of a nearby building to the kindling point.
- 3) fire-brands.--A long-range spread by pieces of burning wood or other materials, carried by the wind.

Fire spreads quickly within buildings. If heat and smoke from lower floors spread quickly to floors above, heat from a ground-floor fire will make a basement of a large building uninhabitable within one hour or less, depending upon the floor plan. It is essential therefore, that fires be extinguished quickly for your basement shelter areas to remain habitable.

Fire Suppression Tasks. Brief those in the shelter as soon as possible on the critical importance of fire-prevention and on the fire regulations that apply in your shelter. Post the sheet of those rules and regulations which you develop. Carry out emergency fire drills if you have sufficient space. If you do not have sufficient space, give oral instructions for suppressing fires. Collect additional

fire-fighting equipment, such as dry chemical extinguishers, and pails of sand. Designate water that can be used to suppress fires. Use water that is not being stored for drinking purposes.

Locate and dispose of such fire hazards as oily rags, crumpled newspaper, dry rotten wood, and corrugated paper cartons. Remember that upholstered furniture and beds in homes will cause fires that will prove difficult to extinguish.

Organize a fire watch throughout the time you are in the shelter. If you have relatively few people in the shelter this can be only one person. Mark the emergency exits which ought to be used in case there is a fire. By this course of action you will be able to get it under control. The fire watch must constantly check for all possible sources of fire, especially cooking areas, exposed wiring, machinery, oxygen containers, such rapidly evaporating substances as fuels, solvents, cleaning agents, and flammable debris. They must also, of course, watch for the possibility of fire being caused by fire-brands from fires elsewhere.

Smoking must be restricted. One of the first things that is necessary for successfully operating a shelter is to designate a specific area for smoking if a safe area is available. If not, then smoking must be eliminated completely. This action will go far in limiting the number of fire-start incidents in your shelter. If you have enough room for a smoking area away from flammable materials and preferably near a ventilation exhaust, the area should be further protected by having sand pails, and other containers suitable for cigarette butts and matches.



How to Extinguish Fires. There are three basic ways to put out fires:

- 1) take away fuel.
- 2) take away air, by smothering the fire.
- 3) lower the temperature by quenching them with water or fire-extinguisher chemicals.

Remember that vaporizing-types of fire extinguishers can produce dangerous fumes if you live in small, enclosed places. If you are in a fallout shelter where water is available for fire-fighting use the building's regular fire-fighting equipment, if there is any. Otherwise use garden hoses, mops and wet blankets, or loose dirt to knock down fires from the burning areas to the point where you could carry or throw smoldering items outside of the building, if this can be done safely. If not, then you have to leave smoldering items where they are, or place them in an unused part of the house.

Even if your shelter is considered to be far from target areas, you should take the following precautions unless otherwise instructed by Civil Defense or other officials.

- 1) Turn off public utility-controlled gas at the meter, or curbcock to prevent possible fires.
- 2) Close blinds and drapes. Drape windows with such opaque materials as whitewash, paint, flour and water mixture, or cover with aluminum foil.
- 3) Move ignitable items--bedding, upholstered furniture, and rugs to areas not exposed to heat coming from outside as a result of initial radiation (heat).
- 4) Members of the home should be prepared to check above the ground parts of your house, particularly the roof, to locate and suppress any smoldering fires that may be started.

## Sleep

Although loss of sleep is less a threat to physical survival than lack of water or food, sleep is necessary to the well-being of persons confined to shelters. People react to long periods of sleeplessness with apathy and listlessness or with irritability or a combination of both. People may also get headaches and nausea and have trouble concentrating because of sleeplessness.

Because sleep requires more time and space than most other activities organize your shelter sleeping arrangements. In most shelters, people will have less space than they would ordinarily desire.

In managing sleep in a fallout shelter, your goal will be to:

1. Establish sleeping arrangements. This includes the sleep schedule, the location of the sleeping areas, and the grouping and positioning of sleepers.
2. Provide or improvise sleeping facilities such as bedding and other sleeping equipment.
3. Solve sleeping arrangement problems and control potential nighttime disturbances such as noise or lighting.

Establishing Sleeping Arrangements. Simultaneous sleeping is better than shift sleeping. If you have adequate space for sleeping, it is usually better for all the people in the shelter to sleep at one time rather than in shifts. Sleeping at one time causes fewer problems in noise control, movement of people within the facility and scheduling of activities. Sleeping at one time is healthier, since one person only will be using a particular cot, mattress, blanket, pillow, and so on.

Shift sleeping will be required if you do not have enough space. If this is necessary keep the number of shifts to two if possible. This

will allow a large period of time each day when the majority of the population can participate in activities. Shift sleeping also allows time for daytime rest periods for children and those people requiring them. The need to provide noise and light levels for the sleep shift may limit the space you can make available by the shift that is awake.

Locating Sleeping Areas. You will need to consider the size and layout of the shelter space, ventilation, noise, and light, and the location of toilets in locating a sleeping area. Separate the sleeping area from the area of greater activity and shift sleeping, either by a barrier or by physical distance. This separation will protect sleepers from ongoing activities in the shelter and not limit those ongoing activities by restricting light and noise in the awake area.

Grouping of Sleepers. Sleepers should generally be separated on the basis of age, sex and marital status. Unmarried men and women, and married persons unaccompanied by spouses or children, should be grouped by sex and assigned to separate sleep areas. Infants and pre-teenagers should sleep near their parents.

If possible a head-to-toe arrangement, as shown in the following diagram, is the best position for sleep, in that it decreases the spread of any respiratory ailments.

Sleep Requirements. Normally children, the elderly, and the infirm will need more sleep than the general adult population. Most people will not sleep or will sleep very little during the first few days in the shelter. After the first few days people will sleep or rest more than they did before going into the shelter, particularly if there is a monotonous environment and possibly less oxygen, water, or food than they are used to.

Sleep Problems. 1. Noise.--Noise within the sleeping area must be kept down to a level that will not interfere with sleep. Noise levels during waking hours in shelters during shelter experiences range from the noise level associated with a business office to the noise emitted by an automobile. Quiet activities that can be scheduled for the one's shift dictates sleeping while others are awake are discussed in the next section, "What To Do."

2. Light.--Lighting must be reduced to a level that will not interfere with sleep. Discourage people from such activities as reading with flashlights after lights out.

3. Social Standards.--You should try to aid people to schedule their sleep and assign areas such that interference with one another that may lead to verbal or even physical confrontations will be minimized.

4. Assistance to Sleepers.--Providing some form of relaxing activity such as reading stories just before lights out can help retain management order just before sleep.

5. Smoking.--Smoking should not be allowed in the immediate sleeping areas. It is a fire hazard and interferes with the rest of the people.

#### What To Do

Religious, Recreation, and Service Activities. Maintaining the morale of the people confined in close quarters and possibly semi-darkness for two weeks is not easy, especially if they are worried about the effect enemy attack may have on the nation and their ways of life. An activity program of some kind will improve the quality of shelter living. This program should provide mild physical exercise and

some activity for their minds and be coupled with the regular survival training and maintenance programs. Although the space will probably be quite limited and the lighting poor in the shelter, there are some programs that can be produced, such as religious services, training and discussion sessions, calisthenics, play activities for children, and if the lighting is adequate, a reading program.

The goals for such activities are basic but important--to keep the shelter group physically and mentally alert and begin preparing them for the day they emerge from the shelter to join a larger recovery effort. Additionally, this program will teach them that they can survive and that there is a future. Such activities will raise morale, help your population to cooperate and socialize and reduce feelings of fear, anxiety and grief, and make the time pass more quickly. They will also help to control undesirable behavior and maintain the peak survival ability. The programs of fire prevention, ventilation, communication, emergency drills, cooking, clean-up, and other on-going activities that must be done should be coordinated with the religious, recreational, and service activities.

Religious Activities. Religious activities should be established as soon as possible with at least one service on the first day in the fallout shelter. The head of the family should ordinarily conduct religious services although others in the shelter group should participate in giving talks, singing hymns and prayers.

Recreation. Two kinds of exercises most suited to limited space are 1) self-initiated, mild exercise; and 2) calisthenics, led by a leader for short periods of time. Isometric exercises are very appropriate if the space is extremely limited. Before establishing

physical activity, judge your available space, the shape of your building, temperature, ventilation, lighting, quantities of food and water (make sure that your population does not need to conserve energy and body fluids, and that temperature and ventilation conditions will allow release of body heat).

Arts and Crafts and Social Activity. Arts and crafts and other lighter, more relaxed activities can be done if you have enough space and light for them. Arts and crafts hold the interest of a group, particularly young children for relatively long periods of time. These activities require little physical exertion and therefore do not generate much heat or noise. Arts and crafts products can be shown and admired and give the young people and others a feeling that something is being done and accomplished.

Some members of the group could make the posters and shelter rules that are helpful in maintaining order, and a feeling of security. People can be encouraged to improvise and use ingenuity with available materials with such activities as pencil sketching, cutting designs from paper, constructing designs from wire, and mobiles. Your group can also engage in games. These games can be enjoyed by both players and onlookers. Improvising checkerboards and pieces, cards, is an important part of the recreational program. A team effort will bring people closer together. Small board games, such as monopoly, are especially good to entertain, distract and comfort people.

Group Singing. A good emotional outlet, which also develops feelings of fellowship and cooperation among the population, is group singing. Postpone spectator entertainment until after the first few days. Children's plays and similar entertainment will keep participants

occupied and provide entertainment for the rest of the group. Schedule this type of entertainment for the evenings when your population may be most tired and in need of nonactive entertainment. Be sure to make full use of the talents of all of those who wish to participate.

Free-time Quiet Activities. It is recommended that some time each day be scheduled for quiet activities. Your groups will need respite from organized activities. Free time will be vital. These quiet periods also reduce noise levels and are particularly useful at the naptime scheduled for the younger children. Encourage individuals to pool those items which will be useful in the quiet times such as books, magazines, and other reading material. There should be some form of library and some method of giving these materials the widest distribution.

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EMERGENCY PREPAREDNESS: A HANDBOOK FOR FAMILIES.(U)  
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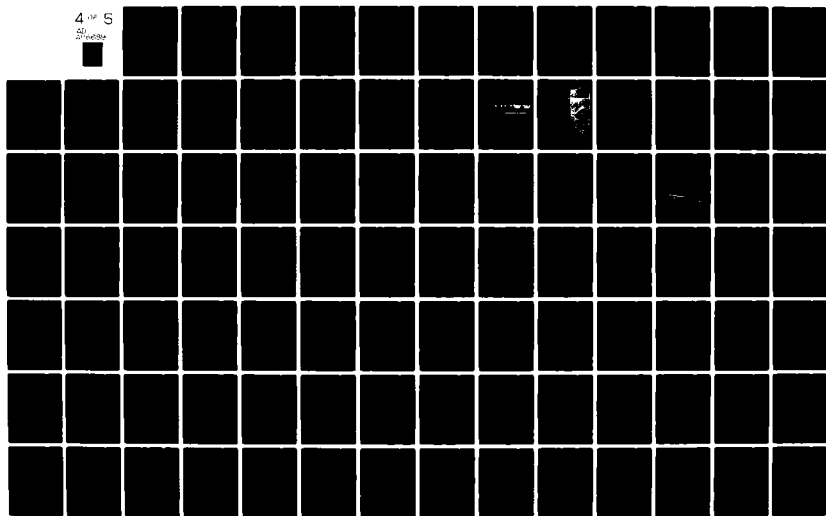
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## Chapter 33

## MEDICAL SELF-HELP

A basic knowledge of first aid is essential to emergency preparedness and could mean the difference between life and death for you, members of your family, or others. Injuries and even death are frequent in many disasters and emergencies. In a crisis it may be necessary for you to provide medical care for yourself, your family, or others for undetermined periods of time. Professional medical help simply may not be available.

Having on hand the medical supplies discussed in an earlier chapter will help you to be prepared better for disaster injuries; however, these items will be almost worthless to you if you do not know how to use them.

Priorities

In disasters many traumatic events may be experienced, resulting in confusion, panic, and emotional instability. It is important that you are prepared to think clearly, and react calmly and appropriately to any health emergencies which may arise. You should know how to diagnose basic problems and what to do about them. In many cases, prompt first aid action is vital to save lives. It is important to treat those who need help first.

If you are faced with a situation in which many victims are in critical need of medical attention, prioritize victims in the following order:

1. First priority:
  - a. airway or breathing difficulties

- b. cardiac arrest
  - c. uncontrolled or severe bleeding
  - d. severe head injuries
  - e. severe medical complications such as poisoning, diabetic problems, etc.
  - f. open chest or abdominal wounds
  - g. severe shock
2. Second priority
- a. burns
  - b. major multiple fractures
  - c. back injuries
3. Third priority
- a. fractures or other minor injuries
  - b. obviously mortal wounds where death is certain
  - c. obviously dead

#### Individual Survey

You must be able to quickly examine an emergency victim, determine those complications which need immediate attention, and provide treatment quickly and properly. Follow these procedures:

1. Arrange for help to be called.
2. If necessary, rescue the victim from a dangerous environment.
3. Treat any obvious critical conditions (severe bleeding, etc.).
4. Quickly check for breathing. Look--for rising and falling of the chest. Listen--for air from the nose or mouth passages. Feel--for air from the nose or mouth passages. If the victim is not breathing, immediately begin mouth-to-mouth or mouth-to-nose artificial respiration.
5. Quickly check for heartbeat. Feel for a pulse at the carotid artery of the neck or the wrist. If there is no pulse, begin

cardiopulmonary resuscitation. If rapid and weak, treat for shock.

6. Examine for severe bleeding, and treat if necessary.
7. Check for signs of shock, and treat if necessary.
8. Check for less serious injuries, and treat.

#### General Guidelines

1. Do no harm. Most often injuries and illnesses are helped by well-meaning, but untrained actions; however, sometimes people can be hurt worse. Get professional medical assistance if possible, rather than attempting first-aid measure beyond your capabilities.
2. Don't move the victim immediately, unless it is necessary because of unsafe environmental conditions. Protect him from disturbances as much as possible, and treat for breathing, bleeding, and broken bones before moving him.
3. Reassure the victim. He will probably be frightened and will need this emotional support.
4. Keep the victim lying down.
5. If the victim is unconscious, or has head or face injuries, turn him to a 3/4-prone position so that he will not choke on blood, vomit, etc.
6. If the victim has a head injury, have the head level or raised in relation to the rest of the body.
7. Watch for symptoms of shock.
8. Maintain body temperature with blankets, etc., but be sure victim does not become overheated.
9. Do not try to give liquids to an unconscious person.

#### Life-threatening Emergencies

The most life-threatening conditions are, in order of danger, (1) impaired breathing, (2) heart failure, (3) severe bleeding, and (4) shock. If a victim were to sustain all of these conditions, you would treat for them in the order given above--a victim will suffocate sooner

than he will bleed to death, bleed to death before he will die of shock, etc.

Impaired Breathing. The average person may die in 6 minutes or less if his oxygen supply is cut off--you must work quickly.

Causes. Obstruction of the airway by the tongue, vomit or blood, foreign objects, swelling of tissues, etc. Asphyxiation from carbon monoxide poisoning, toxic gasses, etc. Electrocution, drowning, electrical shock, heart failure, drug abuse.

Symptoms:

1. Chest or abdomen does not rise and fall.
2. Air cannot be felt or heard exiting from the nose or mouth.

Treatment:

1. Place the patient on his back. Loosen his collar.
2. Open his mouth and use your fingers to remove any food or foreign matter. If he has false teeth or removable dental bridges, take them out.
3. Tilt the head back so that the chin points upward. Lift the lower jaw from beneath and behind so that it juts out. (This prevents blocking of the air passage by the tongue.) Place a pillow under the victim's shoulders to help position his head. He may start breathing at this point, and no further steps will be necessary.
4. Open your mouth widely and take a deep breath.
5. Place your mouth tightly over the victim's mouth so that it is completely covered, and blow in until his chest rises.
6. Remove your mouth from the victim's mouth, and listen for him to exhale the air you just breathed into him. His chest will sink as he does, and you'll feel his breath on your cheek.
7. Continue your breathing for the victim at a rate of about every 5 seconds. (If the victim is an infant or small child, blow small puffs of air into his lungs at a rate of about once every 3 seconds.)
8. If you are not getting air into the patient's lungs, or if he is not exhaling the air you are blowing into him, first make sure that his head is tilted back and his jaw is jutting out in the proper position. Then use your fingers to make sure there

is nothing in his mouth or throat obstructing the airway to his lungs. If this does not help, turn him on his side and strike him sharply between the shoulder blades with the palm of your hand several times. This should dislodge any obstruction in the air passage. Then place him again on his back, with his head tilted back and his jaw jutting out, and resume blowing air into his mouth. If this does not work, try closing his mouth and blowing air through his nose into his lungs.

9. Even if the victim does not respond, continue your efforts for one hour or longer, or until you are completely sure he is dead. If possible, have this confirmed by at least one other person.
10. When a victim begins breathing on his own, do not fight his rate of breathing. Adjust yours to his, until he is sufficiently breathing on his own.
11. Treat the victim immediately for shock.

#### Circulatory Failure

Causes: Unexpected and sudden heart stoppage may be caused by heart attack, drowning, electrical shock, impaired breathing, strangulation, etc.

- Symptoms:
1. Absence of pulse.
  2. Absence of breathing.
  3. Dilated pupils.
  4. Unconsciousness.
  5. Limp body and flaccid skin.
  6. No perceptible heartbeat.

Treatment: If at all possible, get trained help in treating a victim whose heart has stopped beating. It is highly unlikely that an untrained rescuer will be able to restore heartbeat using CPR (cardiopulmonary resuscitation), and he may inflict further injuries on the victim. If you are trained in CPR:

1. Check for response. Gently shake the victim and shout "Are you okay."

2. Check airway. Open the victim's airway by tilting his head back. (Victim should be on his back.)
3. Check breathing. For at least 5 seconds, listen and feel for air exchange and look for chest movements.
4. If not breathing, give four quick full breaths, using the mouth-to-mouth technique.
5. Check pulse. After giving the four breaths, check the pulse using the carotid artery of the neck. (To find, locate the voice box and slide two fingers into the groove between the voice box and the large neck muscle. Press firmly but gently to feel for the pulse and hold for at least five seconds.) If pulse is not present, begin cardiac compressions immediately.
6. Cardiac Compressions. Kneel at the victim's side near his chest. Victim should be lying on his back on a hard, flat surface. Locate the bony tip of the breastbone (sternum) with your ring finger and place two fingers just above that point. Place the heel of your hand adjacent to your fingers and the second hand on top of the first. Position your shoulders directly over the victim's breastbone and press downward, keeping arms straight. Depress the sternum  $1\frac{1}{2}$  to 2 inches for an adult. Depressing and releasing time should be equal. If there is only one rescuer, compressions should be at a rate of 80 per minute with 2 breaths (artificial respiration) after each 15 compressions. Remember to double-check your hand position before continuing compressions. If there are two rescuers, they should be on opposite sides of the victim. One should perform compressions (60 per minute) while the other interposes a breath after every fifth compression, without interrupting the compression rhythm.
7. Signals of effective resuscitation:
  - a. perceptible pulse with each compression
  - b. lungs expand with each breath
  - c. pupils decrease in size
  - d. return of normal heartbeat
  - e. improvement in skin color
  - f. spontaneous gasp; arm or leg movements
8. Continue cardiopulmonary resuscitation until pulse returns or a doctor declares the victim dead.

### Severe Bleeding

Causes: Motor vehicle accidents, mishandling of sharp objects, tools, machinery, and weapons, falls, etc.

Symptoms:

1. Artery--spurting blood, bright red in color.
2. Vein--continuous flow of blood, dark red in color.
3. Capillary--blood oozing from wound.

Treatment: Act quickly if the bleeding is severe. A person may lose consciousness or go into shock upon losing one quart of blood or more.

1. Cover the wound with a clean cloth and apply direct pressure on the wound. If necessary, use your bare hand.
2. If there are no broken bones, elevate the wounded part of the body.
3. If the wound is arterial, you will need to apply pressure at one of the pressure points--wherever the main artery supplying blood to that portion of the body is located.
4. Continue applying direct pressure on the wound until bleeding is under control. Do not remove the gauze or cloth as this will break the clot that has formed. Instead, apply more gauze or bandages on top.
5. Never use a tourniquet, unless it is the only way to save a victim from bleeding to death. If you must use a tourniquet:
  - a. place the tourniquet as close to the wound as possible, and between the wound and the heart
  - b. never use thin materials such as rope, twine, etc., as a tourniquet
  - c. after the tourniquet has been applied, do not loosen it for any reason
  - d. get a physician to treat the patient as quickly as possible.

### Shock

Shock occurs to some degree with almost any injury, however slight. Shock results from the depressed state of vital body functions, causing the cardiovascular system to inadequately supply blood to the various parts of the body. When the body is injured in only one area, the body tends to react as a whole to the physical and emotional trauma. If not treated, shock can result in death of a victim.

Causes: May include serious injury, burns, intense pain, loss of blood, poisoning, fear, anxiety, poisonous gases, surgical operations, extreme heat or cold, etc.

Symptoms:

1. Cool, moist skin. May be dull or chalklike in appearance, pale or bluish in color.
2. Pulse is weak and rapid.
3. Rapid, shallow, irregular breathing.
4. Partial consciousness or unconsciousness.
5. Anxious or dull expression.
6. Victim may be nauseous or thirsty.
7. Dull, lackluster eyes, dilated pupils.

Treatment: All seriously injured persons should be treated for shock, though they may appear normal and alert. Shock may occur even in the absence of physical injury.

1. Keep the victim lying down, with his head lower than the rest of his body, if he does not have a head or chest injury.
2. Loosen tight clothing at the neck, chest, and waist.
3. Maintain body temperature with blankets, etc.
4. Reassure the victim.
5. Encourage the victim to drink fluids if he is conscious and is not nauseated and sustains no abdominal injury. Mix one teaspoon of salt and a half-teaspoon of baking soda to one quart of water, and give him a half-glass of the solution every 15 minutes. Do not give the victim alcohol.



Illnesses and InjuriesBurns

Causes: May vary from overexposure to the sun to contact with strong chemicals or radioactive fallout. Some of the most severe burns result from ignited clothing, flash burns from gasoline, etc., contact with hot liquids, explosions, electrical accidents, etc.

- Treatment:
1. If the burn is minor or first-degree (reddened skin), it is usually best to leave the affected area alone. Do not cover.
  2. The most important things to do about serious burns (blisters, blackened skin) are: (a) treat the victim for shock, (b) prevent infection, and (c) relieve pain. Follow these steps:
    - a. keep the victim lying down, with his head a little lower than his legs and hips, unless he has a head or chest wound, or difficulty in breathing
    - b. have him drink a half-glass every 15 minutes of a salt and soda solution (one teaspoon salt and a half-teaspoon baking soda to a quart of water). Give additional plain water to drink if victim wants it
    - c. cover burned area with dry sterile gauze dressing or clean cloth
    - d. wash area around burn (not the burn itself) for several inches, wiping away from the burn
    - e. use a bandage to hold the dry dressing firmly in place against the burned area. Leave dressings and bandage in place as long as possible.
  3. It is important to immediately cool first and second-degree burns (disregard for third degree burns). Flush the affected area with cold water or apply cold compresses. This should help decrease pain, and may be effective up to 5 hours.
  4. Never pull away clothing that is stuck to a burn--instead cut it away around the burned area.
  5. Do not try to remove cloth, bits of dirt, etc., which may be adhered to the burn.

6. Do not try to clean the burn. Do not use antiseptics on it, and don't break any blisters which may have formed.
7. It is best to keep a burn dry--don't apply grease, butter, ointment, salve, etc., to a severe burn.
8. Do not change dressings applied to a burn until absolutely necessary.

Broken Bones. Bone injuries are most commonly caused by motor vehicle accidents, falls, recreational activities, etc. Very slight injuries may break bones of those with brittle or abnormal bones, particularly the elderly.

Symptoms: Obvious deformities, swelling and discoloration in the area of injury, pain or tenderness to the touch. Victim, if conscious, may report hearing bone snap, grating sensation, abnormal motion, etc.

- Treatment:
1. Do not initially move the victim, unless he is in a dangerous environment.
  2. Check for bleeding and control it.
  3. If available, apply an ice bag to the area, to relieve pain.
  4. Treat the victim for shock.
  5. Fractured arm or leg: straighten out the limb as much as possible, having 2 persons stretch it into a normal position. As a splint, use a board, tree branch, etc. Fasten the arm or leg to the splint with bandages, strips of cloth, belts, neckties, etc. Keep the injured area raised in relation to the body. Check the splint occasionally to make sure that it is not too tight, since the arm or leg may swell more.

If the broken bone is protruding through the skin, let it slip back naturally under the skin when the limb is straightened, if the bone is clean. If it is not clean, cover it with a clean cloth and bandage to stop the wound from bleeding. Splint the limb without trying to straighten it out, and try to find professional medical help.
  6. Fractured collarbone: immobilize by placing the arm on the affected side in a sling, and then binding the arm securely to the body around the trunk.

7. Fractured rib: strap injured portion of the chest with 2-inch adhesive tape, bandage, towel, etc., around and around the entire chest.
8. Fractured neck or back: victim should not be moved until trained help arrives, unless dangerous circumstances necessitate this. If the victim must be moved, place him gently on his back on a stiff board, door, or stretcher. His head, back, and legs should be kept in a straight line at all times. If at any time the victim must be turned, never twist the neck or back, but gently turn the whole body in a smooth motion.

### Poisoning

Causes: Ingestion of poisonous substances (lye, arsenic, etc.), exposure to toxic gases or chemicals, consumption of spoiled food, overdose of drugs or medicines, ingestion of poisonous foods, such as inedible mushrooms or plants, etc.

Symptoms: Clues as to the details of a suspected poisoning will aid you in diagnosing what has taken place. Look for containers of poisonous substances, traces of drug abuse, etc. The victim may be unconscious, or experience a sudden onset of pain or illness. Note burns around the mouth area, breath odor, pupil size. Victims of poisoning may experience nausea, vomiting, or diarrhea. Other symptoms may include convulsions, collapse, paralysis, unusual flushing, paleness or blueness, cramps, unusual urine color, shock, or cardiac arrest.

- Treatment:
1. If available, call a doctor or poison center immediately, and get help and advice.
  2. Dilute the poison with one or two glassfuls of water or milk, if the victim is conscious.
  3. Induce vomiting (if victim is conscious) by administering epecac syrup, or tickling the back of the throat with a blunt object. Do not induce vomiting if the victim is unconscious or convulsing, or has ingested poison containing kerosene, gasoline, lye, strong acids, etc.

Unconsciousness. Common causes of unconsciousness include stroke, head injury, epilepsy, emotional stress, heart attack, etc.

- Treatment:
1. If the victim is not breathing, immediately begin mouth-to-mouth resuscitation.

2. Check for obstructed airway, swallowing of the tongue, etc.
3. Check for clues as to cause of unconsciousness--bleeding, signs of poison ingestion, etc.
4. If the face is bluish and breathing is irregular, lay the victim down and keep him warm. Treat for shock.
5. If victim has a pale face, cold and clammy skin, and a weak pulse, lay him down with head slightly lowered and keep him warm.
6. If the victim's face is reddish and his pulse is strong but slow, lay him down with head slightly raised, and apply cool wet cloths to his head. (Thygerson, p. 214)
7. With all unconscious victims, treat for shock, and watch carefully, particularly noting breathing.

#### Heart Attack

Cause: Clotting in one of the blood vessels leading to the heart.

- Symptoms:
1. Chest pain, which may radiate to shoulder, arm, neck, and jaw areas.
  2. Gasping, shortness of breath.
  3. Unexplained sweating.
  4. Shock.
  5. Prostration.
  6. Extreme pallor or bluish discoloration of lips, skin, and fingernail beds.

- Treatment:
1. Place victim in a comfortable position, usually sitting up.
  2. Provide ventilation; guard against cold.
  3. If victim is not breathing, begin artificial respiration immediately.
  4. If available, send for ambulance equipped with oxygen, and call the victim's doctor.
  5. Give prescribed medications, if any.

Hypothermia, Frostbite

See chapter on Winter Storms.

Radiation Sickness. Radiation sickness is caused by the invisible rays given off by particles of radioactive fallout. If a person receives a large dose of radiation in a short period of time (less than a week) he will become seriously ill, and it is likely that he will die. Victims exposed to a small or medium dose may recover. Beyond potassium iodide (see page 323) there are no known preventive or other medications for radiation sickness.

Symptoms: The early signs of radiation sickness include nausea, lack of appetite, vomiting, weakness, fatigue, and headaches. Later the victim will experience hair loss, diarrhea, a sore mouth, bleeding gums, and bleeding beneath the skin.

Treatment:

1. Have victim rest.
2. Give aspirin for headache.
3. Give liquids for diarrhea and vomiting (1 tablespoon of salt to 1 quart water).

## RURAL RESIDENTIAL SHELTERS

Rural residents have a tradition of helping one another. This tradition of helpfulness was established early in the history of our country through such activities as barn-raising and cooperative harvests. Such cooperation continues in the exchange of goods and services in rural America today.

This cooperative attitude results in non-rural people being assisted as well. Rural dwellers in America have frequently aided endangered urban residents who have fled city areas because of natural or man-made disasters. Rural Americans almost always shelter and otherwise care for those people who face storms or floods as travelers. Studies have consistently shown that city dwellers who might be relocated in rural areas during nuclear crises would likewise be cared for. This willingness of rural Americans to assist others in need is generally found throughout the United States.

Private houses in rural areas may generally protect their occupants and others more in nuclear crisis than urban houses. The main reason for the greater protection of rural residences is that they are away from urban centers which might be potential nuclear targets. Additionally, most of them are located away from military establishments which might also be targets in nuclear war. The immediate and most destructive effects of a nuclear crisis would not affect most rural areas as much as cities. Instead, the major concern would be dealing with fallout resulting from nuclear detonations elsewhere. Rural homes are often less dependent upon municipal utilities than are urban homes. Considerable numbers of rural residences have their own water and sewage

systems, and even have electric power generators. Nevertheless, most rural dwellers are connected to the rest of the world by telephone and television, and other common communication devices. Those living in rural areas often have material resources and skills to improve and improvise shelters, and to deal with emergencies.

#### Determining the Protection Provided

Acting upon a simple act makes it possible to protect people and livestock who are outside the blast and heat areas of a nuclear explosion. ALL MATERIAL BETWEEN THE SOURCE OF RADIATION AND A PERSON OR ANIMAL WILL ABSORB SOME RADIATION ENERGY. The heavier that intervening material is, the more radiation will be absorbed. As an example: two inches of concrete provides more absorption than two inches of wood because concrete is heavier per cubic foot. Therefore, providing protection from nuclear radiation means simply that enough absorptive material for a shelter must be put together to protect people and animals for up to two weeks.

It should be understood that only very strong, reinforced underground shelters might protect against the blast and heat of a nuclear explosion if one occurred nearby. But fallout radiation can be stopped by the shielding that comes from putting dense material between fallout material and those in a shelter.

It is possible for people to stay alive in a shelter that requires relatively little to build and maintain even though they may be uncomfortable. Such a minimum shelter consists of a small shielded area that will just keep people alive. This shelter requires only a very small space, a little water, some food, a way of moderating inside temperatures, and disposing of waste.

With foresight and planning, however, rural residents can construct or upgrade existing buildings to provide shelters that are also comfortable. Such a shelter can have reasonable space, food and water, and some way of moderating inside temperatures. It can also have a variety of items such as a radio, for receiving civil defense announcements, recreational supplies and so on. It may even have emergency power for appliances.

Relative to livestock, shelters can have sufficient shielding and enough feed, water, space and air circulation to prevent almost any permanent damage to animals. This is the type of shelter that this handbook recommends and provides information for developing.

It is important not only for the personal comfort and the convenience of rural people that they consider having such shelters, but it is important for other reasons. First, the productive capacity of the U.S. depends first and foremost on the ability of rural people to produce the food and fiber that are necessary for existence. If rural citizens, particularly farmers, are not protected and if their animals are not protected as well, the recovery period following a nuclear disaster will be extended and difficult, if not utterly impossible.

A second major reason why rural citizens should adequately prepare their shelters is that they will likely be involved in caring for people who may have to be relocated from urban areas. The relocated people will need food and services, if not shelter. Care for the urban evacuees can be coordinated by local governments. But supplying evacuees with food and possibly shelter until the crisis period is over may be required of rural citizens. If this is not done, the evacuees might face severe deprivation or injury, if not death.



All of this means that rural citizens have a great responsibility for adequately sheltering themselves. They provide the potential for a satisfactory recovery following a nuclear crisis, and for the care of people who might have to come to rural areas for safety.

#### Requirements for Adequate Shelters

To meet the needs of protecting the rural family itself, maintaining the productive capabilities of agriculture and assisting others who might be evacuated from urban centers, the minimum needs are:

- 1) The shelter should contain, or have easily accessible, enough feed or food and water for up to two weeks.
- 2) The shelter should contain a reasonable amount of space for each occupant. The space needed for equipment, beds, food, and other things should also be considered.
- 3) The shelter should have emergency power to operate fans and other needed equipment. This is especially important for livestock shelters.
- 4) The shelter must be shielded by enough material to diminish the radiation dose to tolerable levels. Most houses and farms' service buildings do not have adequate shielding and must have more added before they can be used as shelters.

#### Analyzing Existing Buildings

In determining the protection that a home can offer, the discussion of the means of doing so is outlined in Chapter 27, "Protection", which may be used. However, because rural people may have the added responsibility of caring for livestock and also the possibility of having to care for evacuees from urban residences, an elaboration of how to determine the protection factor not only of homes, but of farm buildings is shown. It is possible that people in addition to livestock may have to be sheltered in buildings other than homes.

In discussing shielding requirements and capabilities for rural homes and other buildings in the section below, an awareness of the concept of "Protection Level" is needed. The Protection Level is an indication of the radiation protection which a building is likely to provide. This level is a percentage of the total radiation exposure which an occupant would get if there were no building providing protection. Radiation protection is also measured by "PF" which means "Protection Factor". The Protection Factor measures how safe a person is within a building as compared with being outside in the open with no protection at all. A radiation percentage of two and a half is equivalent of a PF of forty, which means that a person is exposed to forty times less radiation than he would be outside in the open. A PF of 25 is equivalent to four percent \*4%. Acceptable protection levels for humans and livestock are listed below.

	<u>PL</u>	<u>PF</u>
Humans	2.5%	40
Breeding stock	4 %	25
Production animals	7 %	15
Market stock	20 %	5

The protection percentages represent the maximum levels to which a person can be exposed, the PF's are the minimum levels. With certain levels of protection, humans would survive with minimal aftereffects, as shown in Table 1, as cited in the Utah State University bulletin, "Protecting Family and Livestock from Nuclear Fallout," Extension Circular No. 330.

Table 1--Estimated Percent of People Sick According to Radiation Doses  
and Time Exposed

Radiation dose (roentgens)	Time During Which Total Dose is Received				
	1 Day or less	3 Days	1 Week	1 Month	3 Months
0-125	0 to 15%	0-2%	0%	0%	0%
150	25%	10%	2%	0%	0%
200	50%	25%	15%	2%	0%
300	100%	60%	40%	15%	0%
	(15% die)	(5% die)			
450	100%	100%	90%	50%	0-5%
	(50% die)	(25% die)	(15% die)		
650	100%	100%	100%	80%	5-10%
	(95% die)	(90% die)	(40% die)	(10% die)	

#### Improving Shielding

Greater protection comes through increasing the amount of shielding. The protection level and protection factor correspond to the density of the materials used in shielding. The more the material weighs per square foot, the more shielding is provided as shown in Table 2.

Table 2.--Weight of various materials used for shielding

Materials	Pounds per sq. ft. for each 1" thickness
Concrete	12.50
Brick	10.00
Sand and soil	8.50
Standard concrete blocks	7.00
Water	5.25
Small Grain	4.00
Wood	3.00
Baled hay	1.00
Loose hay	.33

### Types of Shielding

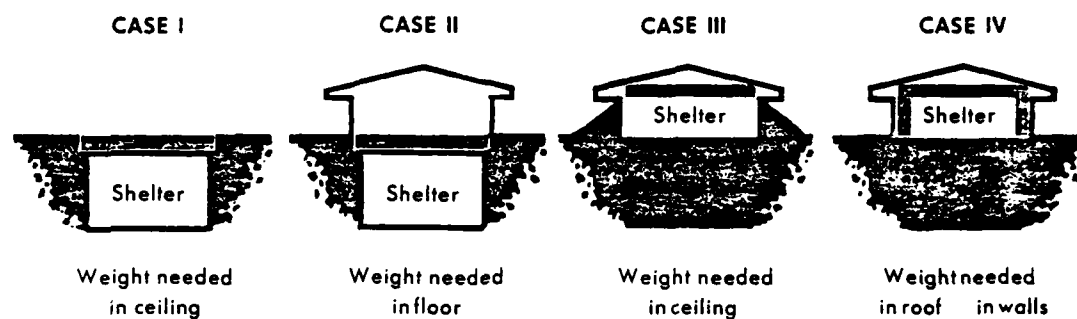
As shown in the figures below, there are four major ways in which shielding can be used to increase the protection factor provided in the building. In case one below, the shelter is below ground and the shielding is on top of the ground with the sides being shielded by earth. In case two, the shelter is below ground with the shielding being provided by the floor of the super-structure of the building provided by heavy materials in the roof and the ground bank on both sides of the shelter. In case three, the shelter is above ground with shielding being provided by heavy materials in the roof and the ground bank on both sides of the shelter. In case four, shielding is provided by weight in the roof and in the walls.

### Adequate Shelters

Examples of improved shielding from Utah State University's Extension Circular No. 320 is shown on this page for various types of buildings.

## WEIGHT OF SHIELDING REQUIRED for the Following Types of Shelters \*

psf = Pounds per square foot



Required Radiation Level	Weight needed in ceiling	Weight needed in floor	Weight needed in ceiling	Weight needed in roof in walls	
2 1/2 percent Family:	85 psf	75 psf	125 psf	150 psf or 100 psf	185psf 250psf
4 percent Breeding stock)	75 psf	70 psf	125 psf	150 psf or 75 psf	150psf 215psf
7 percent Production stock)	50 psf	50 psf	75 psf	150 psf or 75 psf	120psf 130psf
20 percent Market stock)	10 psf	5 psf	25 psf	150 psf or 75 psf	60psf 65psf

\*See Utah State University's Extension Circular No. 330 for details on this and other material used in this chapter.

# ADEQUATE SHELTERS

TYPICAL BUILDINGS WITH SHIELDING IMPROVED

## RECOMMENDED MAXIMUM RADIATION LEVEL WITHIN SHELTERS

Human shelters—2 1/2 percent

Livestock shelters—

Breeding stock—4 percent

Production stock—7 percent

Market stock—20 percent

### BARN LIVESTOCK SHELTER

Provide emergency power, feed and water.

SHIELDING		INSIDE RADIATION
WALLS	CEILING	
Earth bank	16" sand	1%
Earth bank	8" sand	4%
Earth bank	0" sand	9%
Earth bank	16" sand	8%
3 sides, 1 wall exposed		

### HOG OR POULTRY HOUSE

Place a 3' high, 12" concrete wall around the building. Add 4" sand or equivalent to the ceiling. Provide feed and water.

### EMERGENCY LIVESTOCK SHELTER

(When cribs and bins are full)

Stack baled hay inside doors 4' high 10' thick. Provide feed and water.

### BANK BARN (1" roof sheathing and 1" mow floor)

Shield the endwalls with a dirt mound. Provide feed, water, and emergency power.

EXPOSED WALL	INSIDE RADIATION
1" Wood	18%
12" Block	12%
8" Concrete	11%
12" Concrete	8%

### HOUSE

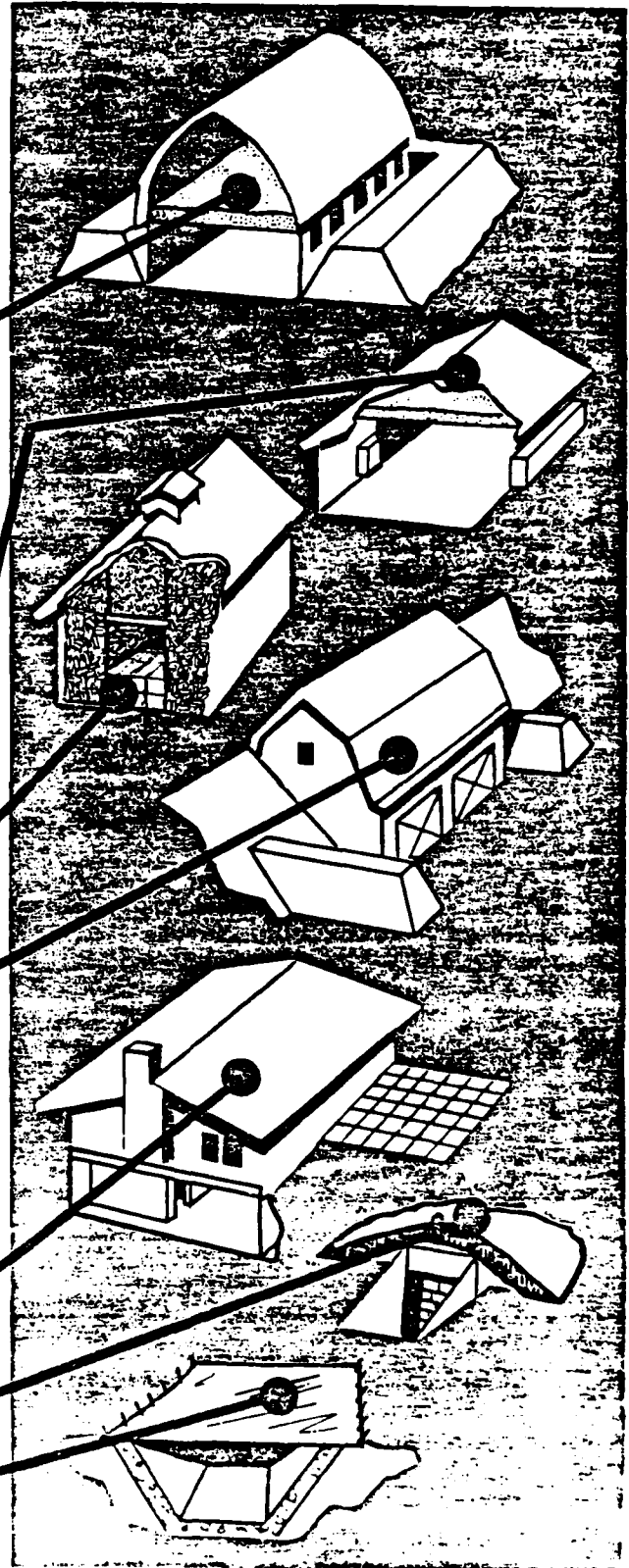
Provide for food and water. Add sufficient shielding to reduce radiation level to 2 1/2%.

### TORNADO SHELTER

Twelve-inch dirt cover: shield entrance. Provide food, water and other supplies.

### EMERGENCY SHELTER (Trench Silo or Concrete Bunker)

Cover trench with plastic before fallout starts. Remove plastic as soon as possible after fallout is down. Provide water.



What to Have

The necessities for human survival for rural people are of course no different than for urban people. That list can be obtained in other chapters. However, an abbreviated list is given below.

WATER & FOOD	MEDICAL
Water (2-wk. supply, 7 gallons per person) Food (2-wk. supply)  utensils  Plates, bowls, cups (preferably disposable) Openers for cans and bottles General-purpose knife  Measuring Cup Cook stove, canned heat, or camp stove Fuel and matches Cooking pans and utensils Baby foods Nursing bottles and nipples	First aid kit and supplies First aid or medical self-help reference Eating  Special Medicines such as insulin or allergy pills Special equipment for invalids
	READING & RECREATIONAL
	Bible or other religious material Civil Defense and medical publications Books or magazines Games (adult and child) Paper, pencils, etc.
SANITATION	GENERAL
Covered can for garbage (20 gal.) Covered pail for toilet purposes Covered can for human wastes (10 gal.) lantern Toilet tissue, paper towels, sanitary lighting napkins, clean rags, ordinary and waterless soap, detergent. Grocery bags, plastic bags, and or newspapers for soil bags Disinfectants and insecticides Waterproof gloves Disposable diapers	Battery-operated radio and spare batteries Flashlight, electric  or other emergency  Dosimeter Home firefighting equipment Shovel, axe, saw, crowbar,  other tools Clothing Bedding Clock and Calendar Rope

What About Other People

It is very likely that rural residents, particularly farm operators, will be requested to help shelter evacuees from threatened

urban areas during nuclear crisis. First priority in sheltering people would be given to rural residents' family members and friends. Others would likely need to be sheltered by rural dwellers in order that lives might be saved. All of the advantages given for providing shelter to others would apply in this instance as well. There would be a supply of workers to help provide for the sheltering of others. These people would bring much of the supplies and food stuffs that would be needed for survival, and they would bring skills and talents that would be useful.

Most of the urban people would not have the know-how to assist in the chores of the farmers, as would others, but they would be expected to learn and take part. Those coming to the rural families for shelter would be expected to assist in caring for the livestock and crops and possibly to help build expedient shelters and to upgrade existing shelters to provide fallout protection.

#### What About Livestock

The survival of livestock is an important element of an assured food supply for the future. Fallout radiation affects livestock much as it does people. Most animals are about as vulnerable as people; however, poultry are much more resistant than other animals. Animals are safest in barns or under roofs, even though other fallout protection is not available. This is because they would not have fallout deposited on their backs which would give them not only gamma radiation but also direct skin burns.

Animals in the pasture are even more vulnerable than they are in an open pen. This is because those in the pasture would also receive internal injuries resulting from the contaminated grass. Ingested



fallout can cause damage to the stomach and the intestines. As a result death can be produced with much lower dosages than otherwise.

#### Animal Shelter Requirement

Providing adequate shelters for all animals may be impractical or impossible. The time and effort needed to feed and water the animals during an emergency may be limited. A farmer might be exposed to hazardous levels of radiation if he spent more than about one hour each day caring for his animals. During this one hour, only limited care could be given to the animals, especially if emergency electrical power were not available.

Because of these limitations, a farmer may have to select a small number of animals to protect and maintain. Agricultural engineers recommend the following: Provide for breeding stock so that all survive. Provide for production animals so most survive. And provide for market animals so about half survive. Shelters should include shielding, uncontaminated feed and water and ventilation.

Consider placing all non-selected animals in a building that would offer at least some protection from fallout.

Water, Feed and Space. Animals can go without water for about 48 hours. They can go without feed for about a week. The amount of feed and water listed in the tables should be readily available and protected against contamination from fallout. Feed stored where fallout particles could not actually get on it would be safe. Examples: hay under canvas, corn in cribs, and grain in elevators.

Water Requirements Per Animal		
Animal	Ample Supply Gal./Day	Limited Supply Gal./Day
Cattle	17	7
Hogs	2 1/2	1 1/4
Poultry		
layers and broilers	1/16	1/20
turkeys	1/3	1/8
Sheep	1 1/2	1

Minimum Feed and Space Requirements of Animals		
Animal	Feed/Day	Space Sq. ft.
Cattle		
Cow	1 lb. hay/cwt. body wt.	20
Calf	1 lb. hay/cwt. body wt. + 1/4 lb. 40% protein suppl.	12
Sheep		
Ewe	1 lb. alfalfa hay/cwt. body wt.	10
Lamb, 60 lb.	1 lb. alfalfa hay/cwt. body wt.	4
Swine		
Lactating sow	5 lbs. corn + 1/2 lb. 35% prot. suppl.	32
Hog 100 lbs.	3 lbs. corn + 1/2 lb. 35% prot. suppl.	4
200 lbs.	4 lbs. corn + 1/2 lb. 35% prot. suppl.	6
Poultry		
Laying hen	1/4 lb. mash	0.7
10 lb. turkey	0.4 lb. mash	1.5
25 lb. turkey	0.7 lb. mash	2.0

Equivalent feeds may be substituted. Hay should be at least 1/2 legume.

Animals off feed 48 hours or more should be limited to about half their normal amount for a day then increase each animal's ration by one pound per day until up to normal.

Ventilation.--In cold and mild weather, ventilation is needed to remove moisture produced by the animals and to remove some of the odors. Some ventilation is needed even in very cold weather.

The summer rates listed in the table are needed during hot weather. About half of the rate is adequate for two or three days if outdoor temperatures stay below 90°F.

Provide the required ventilation with fans or with open windows or panels. Shield these openings to at least the elevation of the animals' backs.

Ventilation Required in Animal Shelters		
Animal	Cfm/Animal Winter	Cfm/Animal Summer
Cattle		
400 lb. calf	30	80
800 lb. dairy	70	200
1000 lb.	100	225
1600 lb.	130	300
Hen	1/2	6
Sheep		
Nursing ewe	10	30
60 lb. lamb	7	20
Swine		
Sow and litter	50	100
100 lb. hog	15	40
200 lb. hog	25	75

During a nuclear emergency, you will probably be unable to care for all your animals. But during a power outage caused by high winds or other cause, you will need enough emergency power to maintain your operation. Thus you may want to provide standby power for the more probable emergency. If you plan in this way, you may have more than would be used during a nuclear emergency.

Installation Suggestions.--List all motors, lights, fans, and other equipment to be operated under emergency conditions. Consult your power supplier. He will help you select a generator, and will provide instructions for installation and use.

The engine or tractor to run the generator should be protected from weather and rodents, adequately vented for dissipation of heat and fumes and maintained in good running condition. Fuel supply should be adequate for at least two weeks.

Locate the generator where it can be used in an emergency with minimum risk to the operator. It should be near the entrance box or fuse panel and preferably in an area shielded from radiation. A transfer switch must be installed between the power supplier's meter and the entrance box and should be within sight of the generator.

Maintenance.--Run the engine and generator for one hour each month to keep the engine's battery charged. Check the wiring and fuel supply.

#### Emergency Operation

1. Disconnect all circuits.
2. Put transfer switch in "generator" position.
3. Check fuel supply.
4. Start engine or tractor.
5. Check voltage; when up to 230v for 120/240v. service, add load.
6. Connect largest load first, then progressively smaller loads.

#### TO RETURN TO COMMERCIAL POWER

1. Disconnect all circuits, stop generator, put transfer switch in "normal power" position.
2. Reconnect circuits, largest load first.

What About Crops

Not too many years ago it was believed that following a nuclear attack large areas of valuable farm land would have to be abandoned for generations because of fallout contamination. This view was based on early estimates of the availability of radioactive strontium in soluble form and the amount that would be taken up by the roots of the growing plants. We now know that radioactive strontium is depleted in heavy fallout areas, and moreover, most of the radioactive material is locked within the glassy particles. In addition, it has been found that crops in the open field do not take up strontium as readily as was assumed. Thus, even though radioactive strontium has a relatively long half-life (about 28 years), crops grown the year following an attack are expected to be fit for human consumption. Moreover, by a year after attack, radiation exposure to farm workers would no longer be of concern.

On the other hand, the yield of growing crops can be reduced or the plants killed by the levels of gamma rays to be expected over wide areas following nuclear attack. Gamma doses that would reduce crop yield fifty percent (50%), on the average, are shown below.

Gamma Dose in Roentgens to Reduce Crop Yield by 50 Percent	
Crops	Yd-50 Dose
Peas, Broadbeans	less than 1000 R
Rye, Barley, Onion	1000 to 2000 R
Wheat, Corn, Oats, Cucumber	2000 to 4000 R
Peanut, Alfalfa, Fescue, Sorghum	4000 to 6000 R
Cotton, Sugar Cane, Melons	6000 to 8000 R
Celery	
Soybeans, Beets, Broccoli,	8000 to 12,000 R
Red Clover	
Rice, Turnips, Sweet Potatoes,	12,000 to 16,000 R
Strawberries	
Squash	16,000 to 24,000 R

It can be seen that peas, broadbeans, rye, barley and onions are far more susceptible to gamma radiation doses than are rice, turnips, sweet potatoes, strawberries and squash. Beta radiation from fallout particles adhering to various parts of the plant or on the ground will add to the dose amounting to from one to twenty times the gamma dose, depending upon the crop and stage of growth. Young, actively growing plants are most vulnerable. Those near maturity are least vulnerable. Severe damage to crops may therefore be expected when the gamma one-week dose is only a few hundred thousand Roentgens. Reduction of this damage through adhering fallout particles can be increased substantially by sprinkler irrigation, by rain, or other moisture sources whatever they may be.

Much more is known about the effects of gamma radiation on plants than the effects of beta radiation. Therefore, the ability to predict injury to plants from fallout is highly unsatisfactory. It will probably remain so for some years to come.

## Chapter 35

## LEAVING SHELTERS

As radiation levels fall, plans for leaving shelters can be made. These plans should take into account the need for action outside the shelter and the hazards presented by radiation and other threats.

Fallout Residues

Gamma radiation from fallout may persist in the post-shelter environment in amounts sufficient to cause injury or death. Studies have been made of possible attacks in which fallout-producing surface explosions are assumed to have occurred. These studies show that by one week after the last detonation, no part of the U.S. would be in a situation where the radiation dose rate is in more than fifty R's per hour. Most areas will have dose rates of less than 0.1R per hour one week after an overall attack. These studies are based on 2500 megaton attacks.

Time would further reduce the fallout radiation hazard. Seven weeks after the attack. If people will follow instructions they can avoid post-shelter radiation sickness by avoiding those places where the gamma radiation effects are dangerous.

Decontamination

Delay in using buildings, equipment, and other materials owing to fallout radiation can be reduced greatly by decontamination, a process in which the deposited fallout is removed from surfaces and places where it can no longer harm people. Ninety percent (90%) of fallout material can be removed in the first few weeks. Removing fallout would restore the contaminated area to a state that would not occur otherwise until

many months of natural diminishing of radiation effects.

Decontamination can be accomplished by using a variety of common efforts.

Brushing fallout particles from grooves and paved surfaces and into the storm drains by means of a fire hose has been found to remove ninety percent (90%) of the fallout material. An hour's work by three men with a firehose will clean about 1800 square feet of roof or 1500 square feet of paved area. Motorized street flushers and sweepers are even more effective on paved areas and three to five times faster. Open ground areas can be scraped by earth moving equipment such as scrapers, diggers or bulldozers. The scrapings must be dumped in a remote corner of the cleared area.

In damaged areas decontamination is difficult. If water pressure has been restored, the preferred method is to firehose an area thirty to fifty feet in radius around the debris pile. Then the street area can be cleared of debris and the remaining fallout in the cleared area can be flushed into the drains. Without water, debris removal must occur first, then motorized sweeping or vacuuming of the fallout.

Decontamination will likely have to be done on a priority basis with key utility plants being decontaminated first. Later, other parts of the communities can be decontaminated. Individuals can be involved in decontamination using household brooms, garden shovels, and hoses.

#### Temporary Emergence

Within 24 hours after a nuclear crisis in which radioactivity is spread, nearly all hazardous fallout will be down on the ground and monitors will have determined how much radiological threat there is for local areas. These readings will be transmitted over the Emergency



Radio Broadcast System and shown on television if transmitters are functional. In those areas where nuclear radiation levels are nonexistent or small, people can come out of their shelters as soon as that information is known. In other areas it will be necessary to wait until radioactivity has been reduced.

Emergency tasks might include the removal of waste and garbage. The dead might be buried, if any. The sick and injured might be relocated to a hospital. Replenishment of shelter supplies might be done also during the brief times that persons are out of shelters. Water is the most important supply to replenish. If water which is uncontaminated or polluted cannot be found, canned or bottled drinks and liquid food might be obtained.

Medical supplies might be brought into the shelter if needed. Sanitation supplies could be obtained. Equipment that is used or is not operating, equipment for ventilation, fire-fighting, communications or illumination, might be obtained. Fresh food might be brought into the shelter. In addition, local officials or those in other shelters might be contacted if this were necessary. Generally, if there is no pressing need for emerging, the population should remain in the shelter. When deciding to leave the shelter temporarily or permanently, the general rule is that the longer the wait, the less the danger.

#### Suggested Limits for Brief Shelter Exists

Brief trips from the shelter and permanent emergence from its confinement should be coordinated with civil defense and other officials, if possible. You can evaluate the information received for your own situation if you know the radiological monitor data, or measure it with your own dosimeter.

### Evacuating Your Shelter

Evacuation of a fallout shelter is a last resort with high radioactive levels outside. Under extreme conditions, such as a major fire, heavy structural damage, highly inadequate ventilation or a high level of radiation within the shelter, evacuation might have to be done. The availability of additional shelter space for your family and others in your home will undoubtedly be severely limited because other buildings will most likely be used as fallout shelters, and they will be crowded. If possible you should contact the civil defense or other officials and receive emergency information as to whether you might go to a public or private shelter, cave or mine, that is only a short distance away. You might try communicating with others in your area who have residences to see if there is room for your people. They may have to be divided into smaller units to be accommodated.

### Emergency Rescue Missions and Escape

There are some emergencies that might occur in shelters that might require evacuation or rescue or emergency missions. Situations that could seriously threaten the survival of those in the shelter could be caused by:

- structural damage to the shelter as the result of nuclear blast
- a severe storm or other natural disaster
- fire in shelter or surrounding area that is uncontrollable
- dangerously high radiation levels in the shelter
- severely high temperatures

--bad air--imbalances in atmospheric conditions, such as an extremely high carbon dioxide concentration or presence of other noxious elements

--depletion of essential supplies, such as water.

Such emergencies require emergency efforts, emergency missions outside the shelter, either temporary or permanent evacuation of the shelter. It is vital, therefore, that those managing the shelter develop a plan of assessment in such emergency situations. This plan should include locating an alternate shelter space and supplies nearby, the degree of radiation protection that can be achieved in other parts of the building, emergency exits, movement of the population and communication with civil defense and other officials for guidance and assistance.

#### Priorities in Choosing Alternate Shelter Areas

Except in the case of a large fire in which people may have to flee the entire surrounding area, you should investigate:

- parts of the building adjoining your shelter which may offer some protection against radiation or which can be quickly upgraded to provide such protection
- other areas in the same building such as upper floors which might be up-graded
- buildings in the area, including public buildings and private homes, easily accessible caves, and mine shafts which provide space for your population.

If possible, delay evacuation as long as possible to allow shelterees to receive considerably lower radiation exposure. Remember that the longer you stay in the shelter the less danger there is as you move from one to another.

Leaving the Shelter Permanently

As mentioned, in some areas it will be possible to leave the shelter within 24 hours of the nuclear threat. However, it is more reasonable to plan for a two-week stay, at least. This time period insures that the shelter may be left under reasonably safe conditions. If there has been extensive fallout in the area, it may be that after two weeks people will be advised to leave the shelter during the day and to return to it for sleeping at night in order to reduce exposure to radiation to tolerable levels.

## Part V

## Responding to Emergencies

## INTRODUCTION

While the destructive potential of man-made disasters has continued to increase greatly during the past century, the capability to deal with such disasters has increased as well.

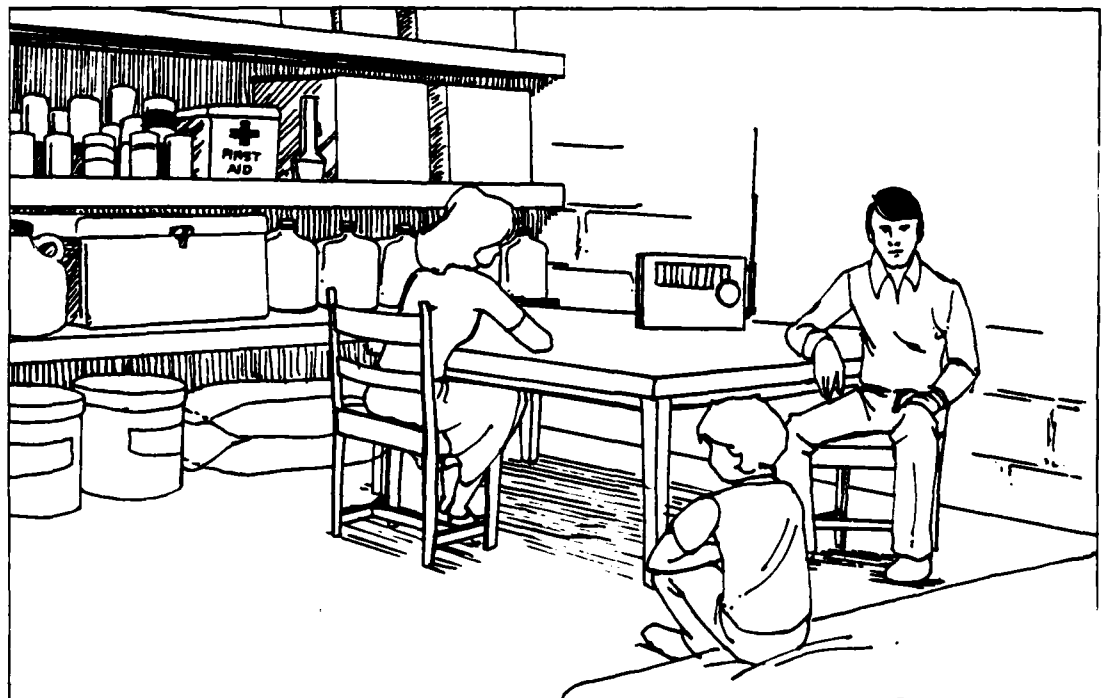
In this section, certain basic ways of dealing with man-made (including nuclear) and natural disasters are outlined.

While some ways of dealing with those disasters have been considered previously in this handbook, crisis counseling, fire suppression, radiation decontamination, damage repairs, sheltering others, and volunteer service have not been fully explained. These topics will be more fully dealt with in this section.

Every person has had various kinds of emergencies in their lifetime. Sometimes these emergencies are threats to life; sometimes they are threats to power, money, or prestige. Whereas in this handbook the focus is more directly upon threats to physical life and functioning rather than economic and social status, similar reactions may be observed. Generally, persons who have learned to effectively deal with emergencies can preserve themselves and others. In addition they can retain their physical health, social and economic position, and valuables.

#### Dealing with Fear

When emergencies occur, especially suddenly, fear is apt to result. Fear, and its various manifestations including stupor, panic, and anxiety, must be recognized in order to be dealt with effectively. In



the table on the following page are listed physical and psychological symptoms of fear. Knowing these symptoms should help in identifying a fear reaction. Once that identification occurs, it can be dealt with more effectively--even positively.

Table 1--Physical and Psychological Symptoms of Fear	
Physical Symptoms	Psychological Symptoms
Quickening of pulse, trembling	Increased hostility or irritability
Dilation of pupils in eyes	Inability to talk at first, followed by yelling or very talkative episodes
Increased muscular tension and movement, followed by fatigue	Confusion, forgetfulness, inability to concentrate on simple tasks or topics
Dry mouth and throat; high-pitched, loud voice, and stammering	Feelings of unreality, panic, stupor, and flight
Faintness, sickness, and lack control	Sleeplessness, fault-finding, and failure to enjoy meals or simple pleasures

As mentioned, fear can bring on many physical and psychological symptoms which may impede effective dealing with matters causing the fear. It is not to be assumed that fear itself is unnatural. Fear is more often than not an appropriate, expected, and realistic response to events.

Four step-by-step suggestions for appropriately dealing with the normal fear are: (1) Recognition, (2) Definition, (3) Preparation, and (4) Action.

## RECOGNITION

It is important to know in advance that fear will occur in situations in which lives or property are threatened. Fear can be expected. When it happens, recognize it for what it is--a normal reaction that affects people in many ways, but which can be directed toward preventing harm and loss of life. Fear often induces sharpness of some sensations, and provides a surge of energy that can be used to avoid the dangers.

## DEFINITION

When those sensations which are associated with fear are induced, define it as fear. Then identify the source of the fear. Analyze what there is in the situation that is provoking the fear--if you have time--and prepare for dealing with it.

## PREPARATION

Before appropriate action can be taken to reduce the source of the fear, alternatives must be considered. It is best to constantly consider alternatives to potential sources of fear as part of your normal living. Then when threats occur you will already have some viable option from which a choice can be made quickly. Airplane pilots are taught to constantly be aware of options associated with possible emergencies. For example, pilots are taught to have emergency landing places located for use if engine failure occurs and attempts to start the engine are unsuccessful. If total engine failure occurred, the pilot would already be prepared to land on the best place possible because of prior preparation.



In your own life, you ought to have in mind various procedures for dealing with many emergencies. These matters were discussed in Chapter 1, "Emergency Plans." These plans ought to take into account as many emergency conditions as might likely happen. If you are driving a car, your thoughts ought to be not only on the possible threatening actions that might be taken by others toward you, but your own reactions to their threatening action. We often call this "defensive driving."

In the same way, we ought to anticipate other emergencies associated with driving such as engine failure, blowouts, sickness on the part of ourselves and passengers, electrical system failure, and losing one's way, and know how to deal with such emergencies in a rational way. Having these options placed before you in your mind will enable rational actions to be taken more easily. All life's activities ought to be planned out as potential emergency situations requiring action.

#### ACTION

Once an emergency has occurred, the options that have been considered in relation to those emergencies can be reviewed very quickly, and the appropriate one considered. Those options should be initiated at once, and carried through to completion. It is important to make sure that a real emergency has occurred, however, not something that just appears to be an emergency or life-threatening situation.

#### Helping Others

If you are aware of fear, and have adopted the means to rationally deal with it, you can help others deal with it, too. The person who has learned to deal with fear in a step-by-step manner will have a positive

mental attitude. That person will not only have control of emotions that might disrupt effective action but will also have plans for getting out of the situation with as little harm as possible. Others, seeing that person, will be prepared to follow his example.

In helping others deal with emergencies, some elemental facts about human behavior ought to be known. These are that:

1. Most people in emergencies are rational, well-ordered persons. If those who are not can see that there is a plan for dealing with the threat, they will return to their normal behavior. It is uncertainty that is most disturbing.
2. There are usually enough rational, prepared, and positive-thinking people to help those who are not.
3. Some people in trouble are slow to ask for help. You may have to show them that you are willing to help them, especially by listening.

#### Listening

During emergencies that persist for extended periods of time, and after any kind of emergency, most persons are benefited if they can tell others about their experiences and emotions. This process of releasing emotions by talking to others is called "catharsis" in counseling. It can be practiced by most people who are interested in others. To be a good listener, it is desirable to:

1. Look at those who are speaking and telling of their feelings and experiences. This indicates that you are really interested in them.
2. Give some responses to their words. If you nod, give occasional "uh huhs," "I see," or other verbal expressions showing genuine interest in what is being said, it encourages the person doing the speaking to tell you all of what occurred. Telling others of emotional experiences tends to speed up the psychological period.
3. If you are not sure just what the person means by some things that are said, ask brief questions for clarification.

4. Avoid interrupting the talker's flow of thoughts and words by descriptions of your own experiences.
5. Be tolerant and willing to accept the person's feelings, thoughts, and actions, even though you might feel them incorrect, ill-advised, or morally wrong. Remember, you are trying to help someone who is experiencing, or who has experienced, a threatening situation. This situation may have brought out some reactions which are not advisable under ordinary circumstances. The person doing the talking may even feel guilty about them and want to "confess" them to others--you. So be prepared to treat them as confidentially and sympathetically as possible.

### Special Groups

Some people in communities have unique needs in disasters. These are people who because of their age, language difficulties, or mental abilities are not able to comprehend what is happening, nor to plan and carry out appropriate responses. These groups may include young children, older people, and those whose ethnic background makes communication difficult.

Some general guidelines for helping these people cope with emergencies are:

1. Calm and reassure them by letting them stay with those with whom they are most familiar such as parents, nurses, and those who speak their own language.
2. Explain to them simply what is happening. If they are cared for by parents, brothers or sisters, nurses, or others, have those people "interpret" to them in their own language what is happening and what they may expect.
3. Let them know who is "in charge," and how they might get answers to questions.
4. Keep families together as much as possible in emergencies. No threat is so great for these people as that of being separated from those who know and care for them.
5. If people must be moved, they should be able to take with them a few treasured items such as blankets, toys, Bible, or photographs.

## FIRE SUPPRESSION

During a major disaster you may be required to extinguish any fires in or near your home without the aid of the fire department. Knowing how to put out fires is very important in the event of a nuclear disaster in which heat flashes could set fire to backyard trash, rooftops, shrubbery, curtains, and most other materials. If you and other survivors can put out these fires you may prevent fires and limit damage to your own property.

Preparation

During a nuclear crisis there are a number of things you can do to ready yourself and your family to handle fire threats. (Refer to the chapter on "Building Fires" for further suggestions and preventions methods.)

First, you must "fire proof" your home as much as possible from heat flashes. Close all windows and remove furniture from window areas. Clear your yard of leaves, paper, and other debris. Keep your trash in covered containers. If you have a coal or wood-burning stove or furnace, extinguish their fires, or at least close fuel and draft doors.

Listen to community broadcasts for emergency information. You may be instructed to shut off utility services which may present a fire hazard. Earthquakes, explosions, or blast waves could damage utility outlets in your home allowing gas or oil to be released into your basement area. Do not light your way into the basement with any type of open flame--gas or oil vapors could cause an explosion.

Do not plan to rely on the established water system to fight any fires which may arise--it may not be available. Create an emergency water supply by filling pails, sinks, bathtubs, swimming pools--even children's plastic pools--and any other large available containers such as garbage cans in and outside your house before fire threatens. Garbage cans lined with new plastic garbage bags can store water that is drinkable.

Have the appropriate types of commercial fire extinguishers ready in your home and place of work. Different types of extinguishers are needed for various kinds of fires. When you buy a fire extinguisher, check the label, which should indicate what types of fire the extinguisher is designed to put out. For example, a pressurized water extinguisher is designed to effectively extinguish a Class "A" fire (in ordinary combustibles such as paper, wood, cloth, plastics, etc.), but will be ineffective against class B or C fires. Class B (oil, grease, paint, etc.) and Class C (electrical wiring, appliances) fires can be extinguished with dry chemical extinguishers, or those containing carbon dioxide or halogenated hydrocarbons.

The most versatile and suitable type of extinguisher for your home would probably be a multi-purpose dry chemical extinguisher, which will extinguish Class A, B, and C fires. These extinguishers weigh from 2½ to 10 pounds, and may be bought for about \$30.

#### Fire Fighting

When fire threatens or strikes your home or property, organize all able-bodied members of your family and neighborhood. The more people you have helping, the more likely you are to extinguish it, or at least contain it, until the fire department becomes available.

All fires require oxygen, heat, and fuel to burn. To extinguish a fire, you must separate or eliminate at least one of these elements.

If the fire is in your yard or on your property, remove all fuel from its path--use rakes, shovels, etc., to clear the area of all brush, debris, and ground cover. While some use water hoses and extinguishers to try to cool the fire, others can attempt to smother it using wet blankets, rugs, sand, and soil.

While such a group effort may prove successful in many cases, realize that fighting a land fire, especially without trained help, can be extremely dangerous. Do not risk your life and the lives of others trying to fight a fire that is obviously out of control. In such circumstances, when the fire department is unavailable, it is best to evacuate the area as quickly as possible.

If the fire is in your home, and you find it in the early stages, attempt to extinguish it using your fire extinguishers, your water supply, wet blankets, and other materials. If possible, get the burning items out of your home or they may ignite other materials and spread fire throughout the house.

Think clearly. Certain types of fire require special precautions. If the fire is in electrical wiring or some type of appliance, turn off the power or pull the plug before doing anything else. If you cannot turn off the electricity for some reason, do not use water to extinguish the fire--you could be severely shocked. Instead, use a dry chemical extinguisher, or smother the fire with blankets, or use earth or sand.

Never try to extinguish an oil or grease fire with water. Such fires may be suppressed with ordinary baking soda, earth, blankets, rugs, etc., or any type of extinguisher which does not use water.

In all fire fighting attempts, use caution. Always know where children are. Never try to fight an established fire when the fire department is available. Get out of the area and wait for them to respond to your call.

## RADIATION PROTECTION AND DECONTAMINATION

One of the major concerns in a nuclear attack is protection from radiation. Radiation is a type of energy caused by changes within atoms, proven to be harmful to living organisms when received in very large amounts. At least 15 percent of the energy of a nuclear explosion is released as radiation--about one third of this energy is emitted during the initial explosion, and the remaining two thirds occur as fallout radiation.

What Is Fallout?

When a nuclear weapon explodes near the ground, great quantities of pulverized earth and other debris are sucked up into the nuclear cloud. There the radioactive gases produced by the explosion condense on and into this debris, producing radioactive fallout particles. In time these particles fall back to earth--the larger ones first, the smaller ones later. On the way down, and after they reach the ground, the radioactive particles give off invisible gamma rays--like X-rays--too much of which can sicken or even kill people.

When and Where Would Fallout Be Most Dangerous?

Generally, the first 24 hours after fallout began to settle would be the most dangerous period to a community's residents. The heavier particles falling during that time would still be highly radioactive. The lighter particles falling later would have lost much of their radiation high in the atmosphere, but could still be very harmful.



Areas close to a nuclear explosion might receive fallout within 15 to 30 minutes. It might take 5 to 10 hours or more for the particles to drift down 100 or 200 miles away.

The distribution of fallout particles after a nuclear attack would depend on wind currents, weather conditions and other factors. There is no way of predicting with certainty what areas of the country would be affected by fallout, or how soon the particles would fall back to earth at a particular location.

Some communities might get a heavy accumulation of fallout, while others might get little or none. No area in the U.S. could be sure of not getting any fallout, and it is probable that some fallout particles would be deposited eventually on most of the country.

In dangerously affected areas the particles themselves would look like grains of salt or sand; but the rays they would give off could not be seen, tasted, smelled, or felt. Specialized instruments (dosimeters) are required to detect the rays and measure their intensity.

#### What Are the Harmful Effects of Radiation Contamination?

Radiation damages and destroys living cells. Humans and animals exposed to small amounts of radioactive material over extended periods of time are not seriously affected; however, death or serious illness results from intense exposure over a short period of time.

Damage and injury occur in one of three ways: through exposure to external radiation (initial explosion energy); internal contamination from affected food, water, air, etc.; or burning and other damage caused by direct contact with fallout.

Radiation Sickness. The invisible gamma rays given off by fallout particles cause radiation sickness--illness resulting from the physical

and chemical changes in the cells of the body. If a person receives a large dose of radiation, cell damage is likely to be so extensive that death may occur. If a person receives only a small amount of exposure the body may repair the damaged cells and get well.

The same dose received over a short period of time is more damaging than if it is received over a longer period. Usually, the effects of a given dose of radiation are more severe in very young and very old persons, and those not in good health.

Following are estimated short-term effects on humans of external exposure to gamma radiation from fallout during a period of less than one week. The total exposure is given in terms of Roentgens (R), a unit for measuring the amount of radiation exposure:

0-50R	No visible effects.
50-200R	Brief periods of nausea on day of exposure. 50% may experience radiation sickness (nausea); 5% may require medical attention; no deaths expected.
200-450R	Most will require medical attention because of serious radiation sickness. 50% deaths within two to four weeks.
450-600R	Serious radiation sickness; all require medical attention. Death for more than 50% within one to three weeks.
Over 600R	Severe radiation sickness. 100% deaths in two weeks.

Symptoms of radiation sickness may not be noticed for several days. The early symptoms are flu-like nature: lack of appetite, nausea, vomiting, fatigue, weakness, and headache. Later, the patient may have sore mouth, loss of hair, bleeding gums, bleeding under the skin, and diarrhea.

### Protection

People can protect themselves against fallout radiation, and have a good chance of surviving it by staying inside a fallout shelter. In most cases, the fallout radiation level outside the shelter would decrease rapidly enough to permit people to leave the shelter within a few days.

A fallout shelter attempts to isolate people from radiation by providing an absorptive barrier to the harmful rays and particles. Any material between people and the source of radiation will absorb some of the radiation energy. Heavier materials are more absorptive and provide better protection--a layer of concrete will absorb more radiation than will wood of the same thickness.

Protection from contaminated food and water. Food and water which has been stored in closed or sealed containers should be free from contamination and safe to use. Provisions in open or broken containers during a nuclear hazard will probably be contaminated by fallout radiation. These items will be safe to use after the fallout particles have been removed from them. (Such decontamination procedures will be outlined later in the chapter.)

As mentioned earlier, food and water exposed to fallout radiation can produce harmful effects if consumed. Therefore, it is very important to be aware of any items which have been exposed to fallout--decontamination is relatively simple, once affected foods have been identified.

Food and water stocks should be carefully scrutinized, and any items suspected to have been exposed to fallout should be removed and not used until decontaminated.

Prevention is obviously the best method of protection. Foods and water which have been stored properly in tightly sealed containers will not be contaminated, while carelessly stored items will require special attention and preparation. Also, care should be taken to avoid contaminating "safe" foods during preparation and serving. Hands, dishes, and utensils should be thoroughly scrubbed before contacting food.

Use of potassium iodide. Another preventive measure which can be taken to avoid internal contamination is the intake of potassium iodide. Contaminated food as well as air may contain radioactive iodides, which are known to cause abnormalities in the thyroid gland. A salt of potassium and iodide taken shortly before inhalation or swallowing of radioactive iodides prevents up to 99 percent of the possible damage to the thyroid gland. The ordinary iodine is absorbed by the thyroid until it is saturated--when intake of radioactive iodides occurs, the thyroid is unable to absorb significant amounts of it, and thus the harmful effects are greatly reduced.

Potassium iodide may be obtained from some chemical supply firms, as well as from drugstores with a prescription. The best form for longterm storage is a dry or crystalline form. A two-fluid-ounce bottle full is adequate for most families, and is very inexpensive.

To prepare a saturated solution of the mixture, fill a bottle about 60 percent full of dry potassium iodide; add water until the bottle is nearly full. Cover and shake vigorously for several minutes. Particles should be visible at the bottom of the bottle as evidence of saturation.

Four drops per day is the recommended dosage for adults and children, and two drops for an infant under one year. Because of the

bitter taste, it will probably be necessary to mix the dosage with food or beverages. Potassium iodide is most effective when taken one half-hour to one day prior to intake of contaminated iodides. (For additional information, see C. H. Kearny, Nuclear War Survival Skills, pp. 100-103).

Protection of materials and equipment. Other provisions, valuables, and personal items may be protected from radiation contamination by enclosing or surrounding them with absorptive material.

Items may be stored in the fallout shelter, in holes, tunnels, caves, basements, etc.

Protection of livestock. Valuable animals and livestock may be protected in shelters built of absorptive materials as discussed in Chapter 34, "Rural Residential Shelters." Shelters for breeding stock would reduce the radiation exposure to 4 percent of the original level, 7 percent for production animals, and 20 percent for market stock.

#### Decontamination

"Decontamination" is the removal of radioactive fallout from the surface of contaminated food, water, people, buildings, sidewalks, and other things. It is done to reduce the hazards of radioactivity.

Human decontamination. After any amount of time spent outside the fallout shelter it will be necessary to get rid of any fallout particles on the clothing and skin before re-entering the protective area.

Clothing should be swept or brushed off thoroughly with brooms, brush, twigs, etc. Those who are brushing off others, should be sure to stand upwind.

Exposed parts of the body should then be thoroughly scrubbed with soap and water. Persons should also rinse their mouths and blow their

noses. If water is not available for washing, the skin may be wiped with clean towels, folded after each wiping.

If possible, it is desirable to thoroughly bathe or shower in uncontaminated water.

Food and water. The danger of people receiving harmful doses of fallout radiation through food or water is very small. Most of the nation's remaining food supplies would be usable after an attack. Since radiation itself passes through food and does not contaminate it, the only danger comes in swallowing fallout particles that happen to be on the food itself or in a food container.

If radioactive dust or particles are visible on food or food containers, it may be removed by wiping or washing off. Grain and other foods which cannot be thoroughly washed can be decontaminated by removing the outer layers and disposing of them.

Water systems might be affected somewhat by radioactive fallout, but the risk is small if a few simple precautions are taken. Water stored in covered containers would not contain fallout particles, and in most cases uncovered water stored indoors would be free from contamination.

Most of the fallout that drops into open reservoirs, lakes, and streams (or open containers or wells) will settle to the bottom, and the upper two-thirds of the water level would be relatively safer to use. Even so, water sources containing fallout particles may be decontaminated by filtering or settling, or both. Filtering contaminated water through ordinary earth can remove up to 99 percent of fallout particles in the water. To make your own earth filter, layer clean pebbles, a porous cloth like burlap, 6 to 7 inches of sub-surface

(at least 4 inches below the ground) soil, and one thickness of terry-like material in a large container with holes punched in the bottom.

The filter may be supported on sticks over a large shallow pan. The contaminated water may be poured into the filter, and allowed to settle. Most of the fallout particles will be trapped in the earth, and the water in the "catch pan" will be safe for cooking and drinking.

Settling is also an effective method of decontamination. To settle fallout particles from contaminated water, stir pulverized clay or clay-like soil into a large container of affected water. Use about a one-inch depth of clay for each 4 inches of water. Let the clay settle for six hours or more. You may then dip out or siphon the water from the container, purify, and use.

Materials, equipment, and buildings. Fallout particles may be removed from clothing by washing in soap or detergent. The surfaces of equipment and buildings may be swept with brooms or wiped off with clean towels. Open shelters may be decontaminated by shoveling off several inches of the surface soil.

## CHEMICAL AND BIOLOGICAL THREATS

Chemical and biological threats to humans are, like nuclear threats, remote possibilities at the present time. However, they do exist and ought to be understood. Industrial accidents involving chemicals or bacteriological organisms have occurred. When they do, they sometimes result in the evacuation of entire communities, loss of life, and injury.

While industrial accidents involving chemical and biological threats are more likely to occur than warfare, they are also much more apt to occur under circumstances in which their effects can be controlled by trained people. Though unlikely, the greatest threat to citizens in the United States would be warfare involving the use of chemical or biological weapons. Most people in the United States are relatively unfamiliar with the means of detecting such threats, and methods of protecting themselves.

In this chapter, therefore, some basic ideas about chemicals and biological threats will be considered. Inasmuch as weapons containing such materials appear to pose the greatest threat to United States citizens, chemical and biological warfare will be the focus. Moreover, much of what is written herein about warfare can be used in the event of an industrial accident or a pestilence.

Chemical Threats

Poisonous chemicals that are used to kill and injure persons, animals, and plants are called "Toxic Materials" or TM. A chemical weapon consists of a toxic material and the means of delivering that



material. The TM called "poison gas" in World War I was delivered primarily by means of artillery shells by both sides in the conflict. Today, however, a variety of both toxic materials and weapons appear to be available in the arsenals of many countries.

#### Basic Characteristics of Toxic Materials

The most important characteristic of toxic materials (TM) is the "toxicity," or, the power to cause damage when they enter an organism, including humans. TM enters humans as a result of breathing contaminated air; having them come in contact with their eyes, skin, or clothing; and eating or drinking them through food, water, and other liquids.

The harmful effects of the toxic materials may be "local" or "general." A local effect occurs when an injury appears in areas where the person has had direct contact with toxic materials--on the skin, nose, throat, eyes, and digestive organs, for example. General effects appear after toxic materials have entered the blood stream and are carried to various organs in the body. Then many parts of the body are affected at the same time.

Toxic materials may be classified further as being "persistent" or "nonpersistent." Persistence is the power to retain their harmful effects for periods of time after they are used. Persistence depends upon the properties of TM used, the method by which they are applied, meteorological conditions, and characteristics of the terrain where they are used.

### Types and Effects of Toxic Materials

Toxic chemicals used in weapons can usually be divided into four general types according to their effects upon humans: nerve-paralysis, skin abscesses, general toxicity, and suffocation.

Nerve-Paralysis Toxic Materials.--These TM include sarin, soman, and V gases (VX). These materials have a powerful and immediate effect on the nervous system. They have great penetrating power. Those persons who are seriously poisoned by them must receive quick and effective treatment, or they will be in danger of losing their lives.

Skin Abscesses Toxic Materials.--Mustard gas and lewisite have a corrosive, rotting effect upon the tissues of the body exposed to them. The bodily areas most usually affected by them are the skin, eyes, and respiratory organs (trachea and lungs). These TM have a potent and penetrating poisoning effect such that recovery time following exposure can be relatively long.

General Toxicity Toxic Materials.--These include prussic acid and cyanogen chloride. Such TM can destroy the ability of cells throughout the body to use oxygen. They have a quick poisoning effect and are very life-threatening.

Suffocation Toxic Materials.--Phosgene is the most common material of this type. It can harm the lungs or even produce suffocation. A herbicide used to defoliate trees and shrubs using cacodylic acid may also be harmful if eaten or drunk by mistake in food or water contaminated by it. When used as a herbicide this material is often colored and used as orange, white, or blue powder to help warn persons of it.

In addition to these materials listed above, another type of toxic material is sometimes used as an irritant. These include chloracetophenone, adamsite, and CS. These "tear gas" materials have an irritating effect on eyes and windpipe and will cause sneezing and flow of tears. Their use is considerably less threatening than the other materials discussed; however, leaving the contaminated area or using a gas mask will cause symptoms induced by them to disappear in 10 to 20 minutes.

Table 1 summarizes the characteristics of toxic materials considered to pose the greatest threat in the event of war. Recommended first-aid procedures, antidotes, and protection devices, and their duration and appearance are also given in Table 1.

#### Delivery of Toxic Materials

Poisonous chemicals may be applied using bombers, rockets, blimps, artillery, and by hand. Chemical bombs may be dropped by airplanes, or sprayed from airplanes in ways similar to those used in aerial spraying of insecticides. When bombs, rockets, or artillery shells are used to spread TM, they may either explode upon contact with the ground or explode in the air. Such explosions are easily seen, and the discharge from them can often be avoided, unless a severe bombardment occurs. For example, a 250 KG (550 pound) bomb armed with phosgene forms a cloud of contaminated air with a diameter of 50 meters (55 yards) and a height of 10 meters (11 yards) with a very high TM concentration. Such a cloud would be moved by wind over a considerable distance with continued high toxicity.

Wind velocity greatly influences the TM concentration. With a gentle wind, contaminated air is slowly dispersed and toxicity

Table 1.--Characteristics of Chemical Weapons (TM) Including Type, State, Time of Effect, Symptoms, Protective Devices, Antidote, and First Aid Procedures

Name	State	Time of Effect	Symptoms	Protective Devices	Antidote	First Aid
Nerve-Paralysis Type						
Sarin	Colorless or yellowish liquid or vapor, slight odor of fruit	30-60 min. by inhalation or direct skin contact	Contraction of pupils; difficulty in breathing; face turns purple, drooling; body breaks out in sweat; contraction of muscles; seizures or spasms.	Gas mask and protective clothing	Ammoniacal-alkali soln. or bleaching powder or calcium hypochlorite	Individual anti-chemical kit, syringe, atropine
Soman	Colorless liquid with weak camphor odor	Same as Sarin	Same as Sarin, but with stronger toxicity and faster effect. Ten times more potent than Sarin.	Same	Same	Same
V-Gases	Aerosol or liquid, odorless	Same as Sarin	Poisoning through respiratory system produces same symptoms as Sarin. Skin contact produces muscle contractions and sweating.	Same	Aq. soln. of bleaching powder or calcium hypochlorite	Same

Table 1.--(Continued)

Name	State	Time of Effect	Symptoms	Protective Devices	Antidote	First Aid
Skin Abscesses Type						
Mustard gas (Yperite)	Vapor or liquid	4-24 hours	Skin Contact produces redness, blisters, and rot. Eyes turn red and are light sensitive. Contact with respiratory organs causes running nose and severe cough. Ingestion produces nausea, vomiting, stomachache and diarrhea.	Same	Bleaching powder and other compounds with active chlorine and their solns.	Individual anti-chemical kit
Suffocating Type						
Phosgene	Gaseous, colorless, rotten grass or apple odor	Immediate	Running eyes and cough occur with contamination; a false recovery will occur less than 15 minutes later, lasting a few hours. Then, difficulty in breathing will occur, purpling of face, coughing up of phlegm and foaming at the mouth.	Gas mask	Not required in open air, ventilate buildings	Oxygen, rest, heat

Table 1.--(Continued)

Name	State	Time of Effect	Symptoms	Protective Devices	Antidote	First Aid
General Toxicity Type						
Prussic or Hydro-cyanic acid	Gaseous, bitter-almond odor	Immediate	Numbness of mouth and tongue; face and lips reddened, headache, difficulty breathing, spasms, dilation pupils.	Gas mask	Not required in open air, ventilate buildings	Amyl nitrite
Irritating Type						
Chlor-aceto-phenone (Tear gas)	Smoke or powder, odor of fruit blossoms	Immediate	Running eyes, pain in eyes and breast bone, sneezing pricking pain on skin.	Gas mask	Same as above	Oxygen, rest

Sources: Translations by Oak Ridge National Laboratory of both Chinese and Soviet civil defense manuals; Chinese Civil Defense, ORNL/TR-4171, August 1977; Civil Defense, Moscow 1970, ORNL-TR-2793, December 1973; were the basis of both Table 1 and Table 2 in this chapter, and much of the narrative content.

sustained. Strong winds rapidly disperse the toxic cloud. With an increase of wind velocity, the TM evaporation from the contaminated area also increases. Heavy rainfall washes the toxic materials from the soil and lowers the contamination density in the area. The greater the vegetation or building density in the contaminated area, however, the longer toxicity is retained.

Toxicity also lasts longer at low winter temperatures or in temperature inversions. This is because evaporation is reduced. In warm temperatures, toxicity is reduced at much higher rates. Toxicity is also more apt to be higher in low areas, particularly those that are moist and covered with thick vegetation, than in high areas exposed to sunlight and wind.

#### Biological Threats

Potential enemies of the United States, particularly the Soviet Union, have many biological weapons which might be used in the event of war. A biological weapon contains an illness-producing microbe or toxin designed to kill or injure people, animals, and plants, and to contaminate food supplies. The concept of a "biological weapon" includes not only bombs, shells, and rocket-launched missiles; but other carriers of microbes and toxins including insects, ticks, rodents, and other pests.

#### Basic Characteristics of Illness-Producing Microbes and Toxins

Two major types of pathogenic or illness-producing substances are likely to be used in biological warfare. These are pathogenic microbes and toxins.

Depending on their structure and biological characteristics, microbes, are classified into four categories: bacteria, viruses, rickettsia, and fungi.

Bacteria are microorganisms of the plant kingdom, usually consisting of single cells visible only under a microscope. Under favorable conditions they multiply rapidly, but are destroyed by light rays, disinfectants, and boiling. They are resistant to low temperatures and freezing. Bacteria causes diseases such as bubonic plague, cholera, and anthrax. Viruses are much smaller than bacteria. They multiply only in live organisms, unlike bacteria.

Viruses are responsible for smallpox, yellow fever, and other diseases.

Fungi, like bacteria, are in the plant kingdom. They are resistant to drying and sunlight.

Rickettsia reproduce and survive only in infected tissue. They cause typhus, Q fever, and other diseases.

Toxins are highly active poisons produced by some microbes. For example, the organisms of botulism, tetanus, and diptheria produce potent toxins. In their more potent form, the toxins retain their potency for weeks or even months.

Listed in Table 2 are disease and death-causing (pathogens) substances that might be used in biological weapons, together with their incubation time, contagiousness, observation period (perceived sick period), and quarantine period and conditions.



Table 2.--Characteristics of Biological Weapons Including Type, Incubation Time, Contagiousness, Observation Period, and Quarantine Period and Conditions.

Name	Incubation Time (Days)	Contagiousness	Observation Period (Days)	Quarantine Period and Conditions
Biological Infections				
Bubonic Plague	1-3	Very dangerous		6 days
Anthrax	1-3	Dangerous	8	8 days in epidemic and the infection by contact
Rabbit Fever	3-6	Not dangerous	6	Not applicable
Spurious Glander (melioidosis)	2-3	Dangerous	14	8 days in an epidemic and the infection by contact
Malleomyces	2-3	Dangerous	14	Same as above
Cholera	1-3	Very dangerous		6 days
Botulism Toxin	2-24	Not dangerous	2	Not applicable
Rickettsiosis				
Exanthematous Pathogens	10-14	Dangerous with pediculosis, i.e., lice infestations	23	23 days under epidemic conditions with pediculosis
Q Fever	10-20	Not dangerous	26	Not applicable

Table 2.--(Continued)

Name	Incubation Time (Days)	Contagiousness	Observation Period (Days)	Quarantine Period and Conditions
Rocky Mountain Fever	3-10	Not dangerous	14	Not applicable
Virus Infections				
Smallpox	13-14	Very dangerous		17 days
Equine enceph- alomyelitis	1-10	Not dangerous	21	Not applicable
Yellow Fever	2-6	Dangerous in the presence of transmitting mosquitos	12	12 days under epidemic con- ditions and in presence of transmitting mosquitos
Psittacosis	8-15	Dangerous	15	15 days in case of epidemic and contact contagion
Mycosis				
Coccidioidomycosis	10-14	Not dangerous	15	Not applicable

Delivery of Pathogenic Microbes and Toxins

Germ warfare involving pathogenic microbes and toxins is most apt to take place among targets away from active fighting. Such places are large and middle-sized cities, factories and mines, communication centers, and areas where military forces are trained are likely targets. Attacks in these places would be done to inhibit production, slow communications, prolong training of replacements, tie up medical personnel, and lower civilian morale. It is possible, too, that some germ warfare using materials with short incubation periods might be used in battle to weaken fighting strength, however.

Three methods of spreading pathogenic microbes and toxins might be used in warfare. These are the use of: (1) aerosol, (2) carriers, and (3) direct application. In the aerosol method, germ warfare materials are sprayed into the air, forming spray or mist which will float in the air for a relatively long time, thus making it possible for people or animals to inhale the materials as they breathe.

Carriers of pathogenic microbes and toxins such as fleas, mice, flies, and inanimate objects carrying germs might also be dropped from airplanes, or released by people on the ground.

Finally, it is possible that secret agents might personally contaminate water sources, food, and air in order to sicken and injure people or animals.

Just as chemical weapons are limited in their effectiveness by terrain, climate, and temperature so are pathogenic microbes and toxins. Dryness, high temperature, and sunshine can speed up the destruction of some pathogenic microbes. The amount of wind that exists can also affect the concentration of microbes and toxins spread as mist or spray. Moreover, the harmful effects of these substances does not begin immediately as with some chemical weapons' substances, so protective measures can be taken in most instances.

#### Protection Against Chemical and Biological Threats

Protection against chemical and biological threats takes many forms. The first is detection of the threat itself. The most obvious threat is the dropping of bombs or shells which give off dust, smoke, or haze in chemical warfare. Or, in the case of biological threats, it is the dropping of weapons which produce sprays or mists. Airplane spraying can be used in both chemical and biological warfare, however. Secondly, laboratory analysis of the chemical or biological weapons' existence can provide warnings.

In both chemical and biological warfare, relocation of populations from the affected areas can reduce greatly the seriousness of the attack. Crisis relocation procedures that apply in the case of a nuclear threat are applicable.

Individual protection can be achieved by wearing protective clothing which can resist both chemical and biological substances. Specialized clothing is not readily available at the present time except to members of the military. However, plastic raingear and gloves (a rubber glove) and facial covering will provide substantial protection from non-gaseous substances while escaping from the threat or conducting decontamination.

Hermetically sealed shelters are available in some areas, together with air circulation systems which screen out both dangerous chemicals and bio-organisms. These shelters are ordinarily not as available to the civil population in the United States as they are in some other countries, however.

Instructions for dealing with chemical and biological threats may be expected as part of the many instructions that will be given during large-scale emergencies.

## Part VI

## References

In this part of the handbook references are given for each chapter and for the entire manuscript. There are other references cited in each chapter as well where considered timely and important.

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## Part VII

## Appendices

The unique work done at the Oak Ridge National Laboratory by the indefatigable Cresson H. Kearny and associated researchers is very important in civil defense. Not only are those efforts recognized in the United States, but overseas as well.

The two appendices contain just a small portion of that effort, the first being an explanation of the Kearny Air Pump (KAP). This pump can be used to provide life-saving circulation in shelters. The second appendix gives some of the many plans for constructing expedient shelters developed and thoroughly tested at ORNL. These shelters have been tested in direct comparison with those developed by the USSR and the Peoples' Republic of China. These have been shown to be superior in certain important ways.

## Appendix A

## How to Make and Use a Homemade Shelter-Ventilating Pump, the KAP

### I. THE NEED FOR SHELTER AIR PUMPS

In warm weather, large volumes of outside air **MUST** be pumped through most fallout or blast shelters if they are crowded and occupied for a day or more. Otherwise, the shelter occupants' body heat and water vapor will raise the temperature-humidity conditions to **DANGEROUSLY** high levels. If adequate volumes of outdoor air are pumped through typical belowground shelters in hot weather, many times the number of persons could survive the heat than otherwise could survive in these same shelters without adequate forced ventilation. Even in cold weather, about 3 cubic feet per minute (3 cfm) of outdoor air usually should be pumped through shelters, primarily to keep the carbon dioxide exhaled by shelter occupants from rising to harmful concentrations.

The KAP (Kearny Air Pump) is a practical, do-it-yourself device for pumping adequate volumes of cooling air through shelters—with minimum work. The following instructions have been improved repeatedly after being used by dozens of small groups to build KAPs—including families, pairs of housewives, and children. None of these inexpert builders had previously heard of this kind of pump, yet almost all groups succeeded in making one in less than 4 hours after assembling the materials. Their successes prove that almost anyone, if given these detailed and thoroughly tested instructions, can build a serviceable, large-volume air pump of this simple type, using only materials and tools found in most American homes.

If possible, build a KAP large enough to pump through your shelter at least 40 cubic feet per minute

(40 cfm) of outdoor air for each shelter occupant. If 40 cfm of outdoor air is pumped through a shelter and distributed within it as specified below, even under heat-wave conditions the effective temperature of the shelter air will not be more than 2° F higher than the effective temperature outdoors. (The effective temperature is a measure of air's effects on people due to its heat, humidity, and velocity.) The 36-inch-high by 29-inch-wide KAP described in these instructions, if used as specified, will pump at least 1000 cfm of outside air through a shelter that has the airflow characteristics outlined in these instructions.

If more than 25 persons might be expected to occupy a shelter during hot weather, then it is advisable to build a larger KAP. The 72-inch-high by 29-inch-wide model described can pump between 4000 and 5000 cfm.

To maintain tolerable temperature-humidity conditions for people in your shelter during hot weather, you **must**:

- Pump enough outdoor air all the way through the shelter (40 cfm for each occupant in very hot, humid weather).
- Distribute the air evenly within the shelter. If the KAP that pumps air through the shelter does not create air movement that can be felt in all parts of the shelter in hot weather, one or more additional KAPs will be needed to circulate the air and gently fan the occupants.
- Encourage the shelter occupants to wear as little clothing as practical when they are hot. (Sweat evaporates and cools best on bare skin.)

- Supply the occupants with adequate water and salt. For prolonged shelter occupancy under heat-wave conditions in a hot part of the country, about 4 quarts of drinking water and  $\frac{1}{3}$  ounce (1 tablespoon) of salt per person are required every 24 hours, including salt in food that is eaten. Normal American meals supply about  $\frac{1}{4}$  ounce of salt daily. Salt taken in addition to that in food should be dissolved in the drinking water.

- Pump outdoor air through your shelter day and night in warm weather, so that both the occupants and the shelter are cooled off at night.

Almost all of the danger from fallout is caused by radiation from visible fallout particles of heavy, sand-like material. The air does not become radioactive due to the radiation continuously given off by fallout particles.

The visible fallout particles rapidly "fall out" of slow moving air. The air that a KAP pumps through a shelter moves at a low speed and could carry into the shelter only a very small fraction of the fallout particles that cause the radiation hazard outside. This fraction, usually not dangerous, can be further reduced if occupants take the simple precautions described in these instructions.

### CAUTION

Before anyone starts to build this unusual type of air pump, **ALL WORKERS SHOULD READ THESE INSTRUCTIONS AT LEAST UP TO SECTION V, INSTALLATION.** Otherwise, mistakes may be made and work may be divided inefficiently.

When getting ready to build this pump, all workers should spend the first half-hour studying these instructions and getting organized. Then, after materials are assembled, two inexperienced persons working together should be able to complete the 3-foot model described in the following pages in less than 4 hours. To speed up completion, divide the work; for example, one person can start making the flaps while another begins work on the pump frame.

## II. HOW A KAP WORKS

As can be seen in Figs. 1 and 2, a KAP operates by being swung like a pendulum. It is hinged at the top of its swinging frame. When this air pump is pulled by a cord as illustrated, its flaps are closed by air pressure and it pushes air in front of it and "sucks"

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UNUSED PARTS OF DOORWAY COVERED,

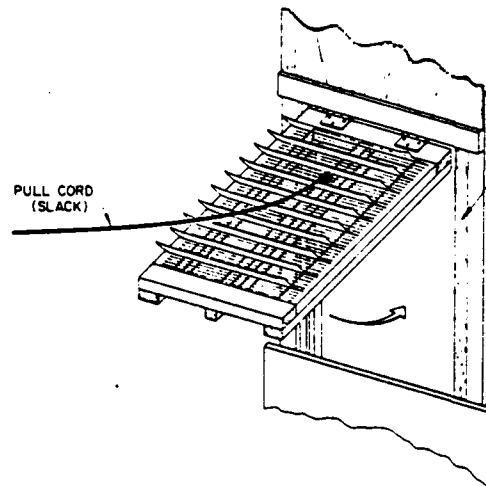


Fig. 1. Section through the upper part of a doorway, showing operation of a KAP.

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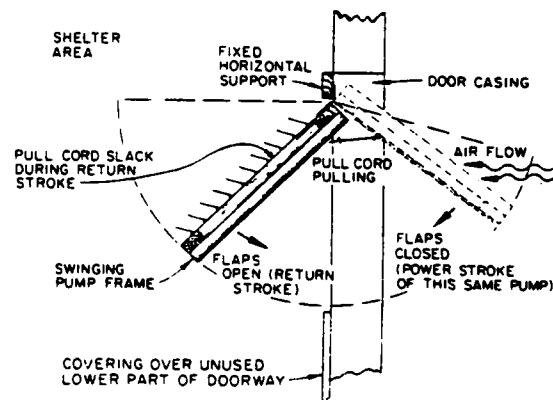


Fig. 2. KAP in doorway (with flaps open during its return stroke).

air in back of it. Thus a KAP pumps air through the opening in which it swings. This is the power stroke. During its power stroke, the pump's flaps are closed against its flap-stop wires or strings, which are fastened across the face of the frame.

When a KAP swings freely back as a pendulum on its return stroke, all its flaps are opened by air

pressure. The pumped air stream continues to flow in the direction in which it has been accelerated by the power stroke, while the pump itself swings in the opposite direction (see Fig. 2). Thus the flaps are one-way valves that operate to force air to flow in one direction, where desired.

The KAP can be used: (1) to supply outdoor air to a shelter, (2) to distribute air within a shelter, and/or to fan the occupants.

1. To force outdoor air through a shelter, an air-supply KAP usually is operated as an air-intake pump by pulling it with a cord (see Fig. 1). (Only rarely is it necessary to operate a KAP as an air-exhaust pump by pushing it with a pole, as described in the last section of these instructions.)

2. To distribute air within a shelter and/or to fan the occupants, air-distribution KAPs may be hung overhead and operated as described later.

### III. INSTRUCTIONS FOR BUILDING A KAP

In this section, instructions are given for making a KAP 36 inches high and 29 inches wide, to operate efficiently when swinging in a typical home basement doorway 30 inches wide. If your doorway or other ventilation opening is narrower or wider than 30 inches, you should make your KAP 1 inch narrower than the narrowest opening in which you plan to install it. Regardless of the size of the KAP you plan to build, first study the instructions for making the 36 × 29-inch model.

In Section VII you will find brief instructions for making a narrower and even simpler KAP, one more suitable for the narrow openings of small trench shelters and other small expedient shelters. Section VIII covers large KAPs, for large shelters.

#### A. Materials Needed for a KAP 36 inches High by 29 inches Wide

The preferred material is listed as first (1st) choice, and the less-preferred materials are listed as (2nd), (3rd), and (4th) choices. It is best to assemble, spread out, and check all your materials before beginning to build.

#### 1. The pump frame and its fixed support:

- Boards for the frame:
  - (1st) 22 ft of 1 × 2-in. boards. (A nominal 1 × 2-in. board actually measures about

$\frac{3}{4}$  × 1- $\frac{1}{2}$  in., but the usual, nominal dimensions will be given throughout these instructions.) Also, 6 ft of 1 × 1-in. boards. Soft wood is better.

(2nd) Boards of the same length that have approximately the same dimensions as 1 × 2-in. and 1 × 1-in. lumber.

(3rd) Straight sticks or metal strips that can be cut and fitted to make a flat-faced KAP frame.

- Hinges: (1st) Door or cabinet butt-hinges; (2nd) metal strap-hinges; (3rd) improvised hinges made of leather, woven straps, cords, or 4 eyescrews which can be joined to make 2 hinges. (Screws are best for attaching hinges. If nails are used, they should go through the board and their ends should be bent over and clinched—flattened against the surface of the board.)

- A board for the fixed horizontal support: (1st) A 1 × 4-in. board that is at least 1 ft longer than the width of the opening in which you plan to swing your pump; (2nd) A wider board.

- Small nails (at least 24): (1st) No. 6 box nails, about  $\frac{1}{2}$  in. longer than the thickness of the two boards, so their pointed ends can be bent over and clinched; (2nd) other small nails.

#### 2. The flaps (See Figs. 1, 2, 6, 7, and 8):

- Plastic film or other very light, flexible material—12 square feet in pieces that can be cut into 9 rectangular strips, each 30 × 5 $\frac{1}{2}$  in.: (1st) polyethylene film 3 or 4 mils thick (3 or 4 one-thousandths of an inch); (2nd) 2-mil polyethylene from large trash bags; (3rd) tough paper.

- Pressure-sensitive waterproof tape, enough to make 30 ft of tape  $\frac{3}{4}$  in. to 1 in. wide, for securing the hem-tunnels of the flaps: (1st) cloth duct tape (silver tape); (2nd) glass tape; (3rd) scotch tape; (4th) freezer or masking tape, or sew the hem tunnels. (Do not use a tape that stretches: it may shrink afterward and cause the flaps to wrinkle.)

#### 3. The flap pivot-wires:

(1st) 30 ft of smooth wire at least as heavy and springy as coat hanger wire, that can be made into very straight pieces each 29 in. long (nine all-wire coat hangers will supply enough); (2nd) 35 ft of somewhat thinner wire, including light, flexible insulated wire; (3rd) 35 ft of smooth string, preferably nylon string about the diameter of coat hanger wire.

#### 4. The pull cord:

(1st) At least 10 ft of cord; (2nd) strong string; (3rd) flexible, light wire.

#### 5. The flap-stops:

- (1st) 150 ft of light string; (2nd) 150 ft of light, smooth wire; (3rd) 150 ft of very strong thread; (4th) 600 ft of ordinary thread, to provide 4 threads for each stop-flap.
- (1st) 90 tacks (not thumbtacks); (2nd) 90 small nails. (Tacks or nails are desirable but not essential, since the flap-stops can be tied to the frame.)

#### B. Tools

A hammer, saw, wirecutter pliers, screwdriver, scissors, knife, yardstick, and pencil are desirable. However, only a strong, sharp knife is essential for making some models.

#### C. Building a KAP 36 inches High by 29 inches Wide

A 36×29-in. KAP is most effective if operated in an air-intake or exhaust opening about 40 in. high and 30 in. wide. (If your shelter might have more than 25 occupants in hot weather, read all these instructions so you will understand how to build a larger pump, briefly described in Section VIII.)

**NOTE THAT THE WIDTHS AND THICKNESSES OF ALL FRAME PIECES ARE EXAGGERATED IN ALL ILLUSTRATIONS.**

##### 1. The frame

a. Cut two pieces of 1×2-in. boards, each 36 in. long, and two pieces of 1×2-in. boards, each 29 in. long; then nail them together (see Fig. 3). Use nails that do not split the wood, preferably long enough to go through the boards and stick out about  $\frac{1}{2}$  in. on the other side. (To nail in this manner, first put blocks under the frame so that the nail points will not strike the floor.) Bend over nail points which go through.

Next, cut and nail to the frame a piece of 1×1-in. lumber 36 in. long, for a center vertical brace. (If you lack time to make or to find a 1×1-in. board, use a 1×2-in. board.) Figure 3 shows the back side of the frame; the flap valves will be attached on the front (the opposite) side.

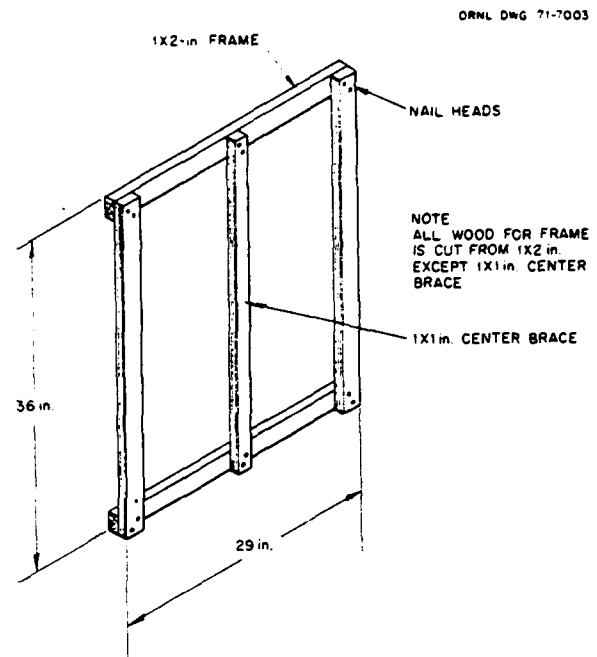


Fig. 3. KAP frame (looking at the back side of the frame).

b. To make the front side smooth and flat so that the flaps will close tightly, fill in the spaces as follows: Cut two pieces of 1×2-in. boards long enough to fill in the spaces on top of the 36-in. sides of the frame between the top and bottom horizontal boards, and nail these filler boards in place. Do the same thing with a 1×1-in. board (or a board the size of that used for the center brace) as a filler board for the center brace (see Fig. 4).

If the frame is made of only one thickness of board  $\frac{3}{4}$  in. to 1 in. thick, it will not be sufficiently heavy to swing back far enough on its free-swinging return stroke.

## 2. The hinges

Ordinary door butt-hinges are best. So that the pump can swing past the horizontal position, the hinges should be screwed onto the front of the frame, at its top, in the positions shown in Fig. 4. (Pick one of the 29-in. boards and call it the top.) If you do not have a drill for drilling a screw hole, you can make a hole by driving a nail and then pulling it out. Screw the screw into the nail hole.

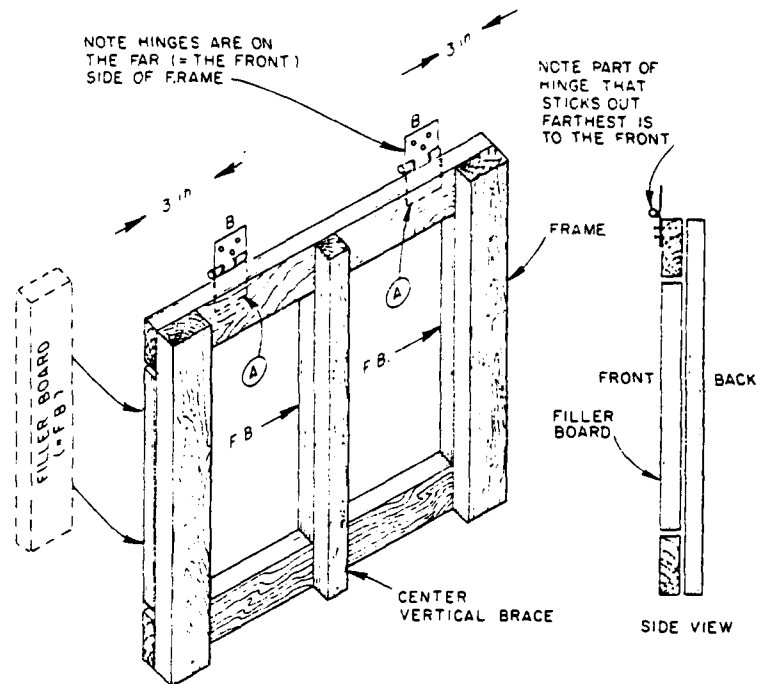


Fig. 4. Completing the frame.

## 3. The pivot-wires and flaps

a. Make 9 flap pivot-wires. If you have smooth, straight wire as springy and thick as coat hanger wire, use it to make nine 29-in.-long straight lengths of wire. If not, use wire from all-wire coat hangers or use strings. First, cut off all of the hook portion of each coat hanger, including the twisted part. If you have only ordinary pliers, use the cutter to "bite" the wire all around; it will break at this point if bent there. Next, **straighten** each wire **carefully**. Straighten all the bends so that each wire is straight within  $\frac{1}{4}$  in., as compared to a straight line. Proper straightening takes 1 to 5 minutes per wire. To straighten, repeatedly grasp the bent part of the wire with pliers in slightly different spots, each time bending the wire a little with your other hand. Then cut each wire to a 29-in. length. Finally, bend no more than  $\frac{1}{2}$  in. of each end at a right angle and in the same plane – that is, in directions so that all parts of the bent wire will lie flat against a smooth surface. The bent ends are for secure attachment later (see Fig. 5).

b. Make 9 polyethylene flaps that will be the red valves of the KAP. First cut 9 strips,

making each strip 30 in. long by  $5\frac{1}{2}$ -in. wide (see Fig. 5). To cut plastic flaps quickly and accurately, cut a long strip of plastic 30 in. wide. Then cut off a flap in this way: (1) draw a cutting guideline on a wide board  $5\frac{1}{2}$  in. from an edge; (2) place the 30-in.-wide plastic strip so that it lies on this board, with one of the strip's side edges just reaching the edge of the board; (3) place a second board over

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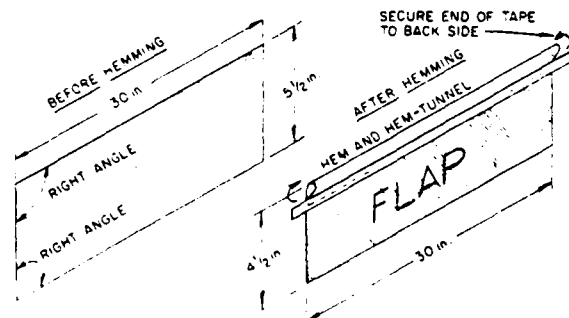


Fig. 5.



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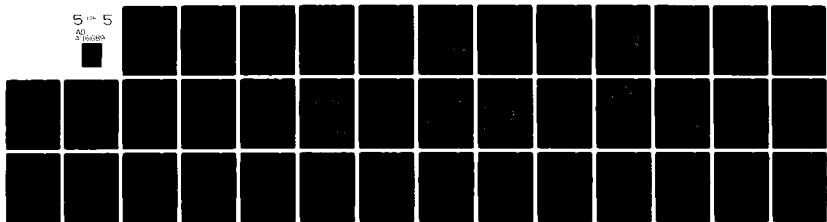
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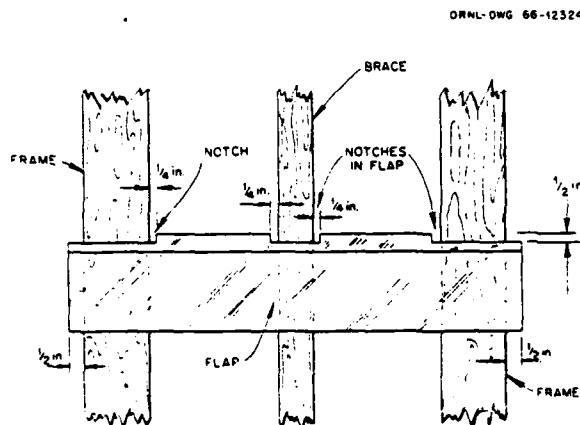
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the plastic on the first board, with a straight edge of this second upper board over the guideline on the lower board; and finally (4) cut off a flap by running a **sharp** knife along the straight edge of the upper board.

To form a hem along one of the 30-in. sides of a  $5\frac{1}{2} \times 30$ -in. rectangular strip, fold in a 1-in. hem. This makes the finished flap  $4\frac{1}{2}$  in. wide.

To hold the folded hem while taping it, paper clips or another pair of hands are helpful. For each hem, use two pieces of pressure-sensitive tape, each about 1 in. wide and 16 in. long. Or make the hem by sewing it very close to the cut edge to form a hem-tunnel (see Fig. 5).

After the hem has been made, cut a notch with scissors in each hemmed corner of the flap (Figs. 6 and 8). Avoid cutting the tape holding the hem. Each notch should extend downward about  $\frac{1}{2}$  in. and should extend horizontally from the outer edge of the flap to  $\frac{1}{4}$  in. inside the inner side of the frame, when the flap is positioned on the frames as shown in Fig. 6.

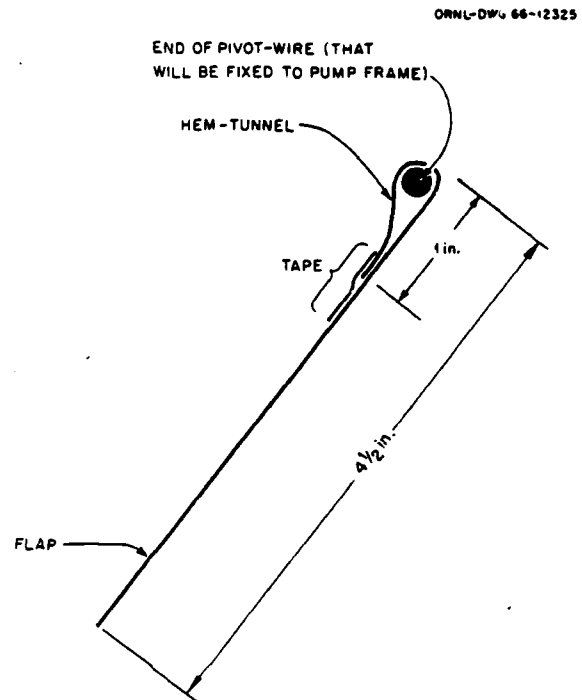


**Fig. 6. Sizes of notches in flaps.**

Also cut a notch in the center of the flap (along the hem line) extending  $\frac{1}{2}$  in. downward and extending horizontally  $\frac{1}{4}$  in. beyond each of the two sides of the vertical brace (see Fig. 6). The notch **MUST** be wider than the brace. [However, if you are building a pump using wire netting for flap-stops (see Fig. 13), then do **NOT** cut a notch in the center of each flap.]

- c. Take the 9 pieces of straightened wire and insert one of them into and through the hem-tunnel

of each flap, like a curtain rod running through the hem of a curtain. Check to see that each flap **swings** freely on its pivot-wire, as illustrated by Fig. 7. Also see Fig. 8.



**Fig. 7. End view.**

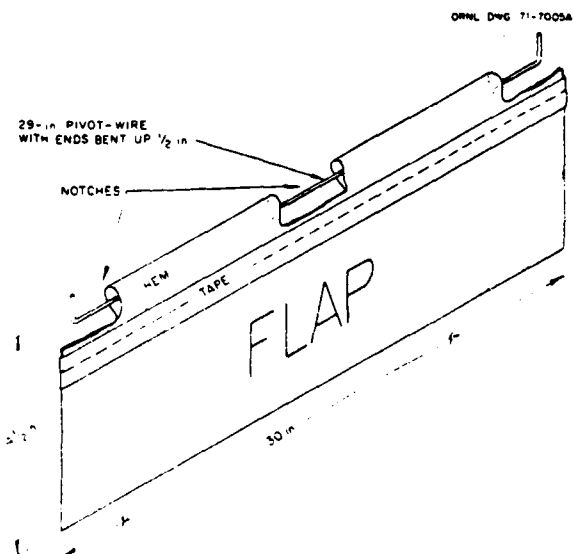


Fig. 8.

d. Put aside the flaps and their pivot-wires for use after you have attached the flap-stops and the hinges to the frame, as described below.

e. Using the ruler printed on the edge of this page, mark the positions of each pivot-wire (the arrowheads numbered 0,  $3\frac{5}{8}$ ,  $7\frac{1}{4}$  in.) and the position of each flap-stop (the four marks between each pair of numbered arrowheads on this ruler). All of these positions should be marked both on the vertical sides of the 36-in.-long boards of the frame and on the vertical brace. Mark the position of the uppermost pivot-wire (the "0" arrowhead on this ruler)  $\frac{1}{4}$  in. below the top board to which the hinges have been attached (see Figs. 9 and 10).

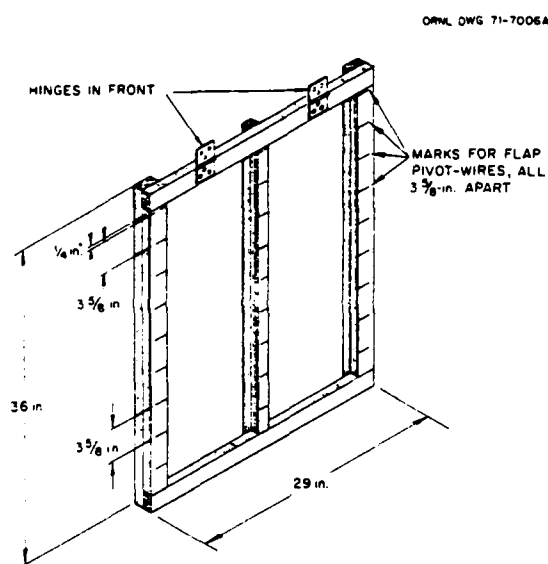


Fig. 9.

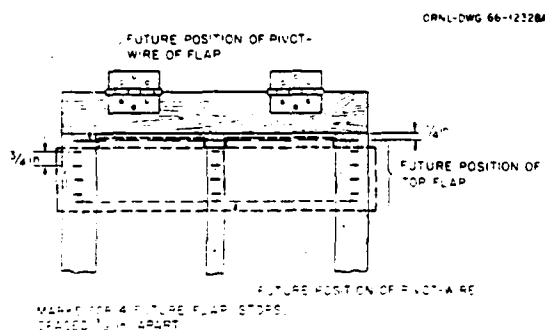


Fig. 10.

#### 4. The flap-stops

So that the flaps may swing open on only one side of the frame (on its front, or face), you must attach horizontal flap-stops made of strings or wires across the face of the frame. (See Figs. 10 and 11.) Nail or tie four of these flap-stops between the marked points where each pair of the horizontal pivot-wires for the flaps will be placed. Be careful not to connect any flap-stops in such a way that they cross the horizontal open spaces in which you later will attach the flap pivot-wires.

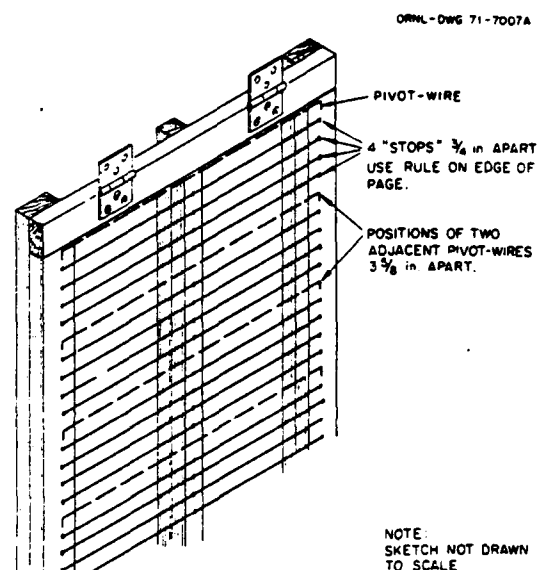


Fig. 11. Positions of pivot-wires and flap-stops.

If you have tacks (NOT thumbtacks) or very small nails, drive three in a horizontal line to attach each flap-stop—two in the vertical 36-in. sides of the frame and one in the vertical center brace (see Fig. 11). First, drive all of these horizontal lines of tacks about three-quarters of the way into the boards. Then, to secure the flap-stop string or thin wire quickly to a tack, wind the string around the tack and immediately drive the tack tightly into the frame to grip the string (see Fig. 11).

If you have no tacks or nails, cut notches or slots where the flap-stops are to be attached. Cut these notches in the edges of the vertical sides of the frame and in an edge of the center brace. Next, secure the flap-stops (strings or wires) by tying each

RULER FOR MARKING POSITIONS OF FLAP PIVOT-WIRES AND FLAP-STOPS

7 1/4 in.

one in its notched position. This tying should include wrapping each horizontal flap-stop once around the vertical center brace. The stops should be in line with (in the same plane as) the front of the frame. Do not stretch flap-stops too tightly, or you may bend the frame.

### 5. Final assembly

a. Staple, nail, or tie the 9 flap pivot-wires or pivot-strings (each with its flap attached) in their positions at the marked  $3\frac{5}{8}$ -in. spacings. Start with the lowest flap and work upward (see Fig. 11). Connect each pivot-wire at both ends to the 36-in. vertical sides of the frame. **Also connect it to the vertical brace. BE CAREFUL TO NAIL THE PIVOT-WIRES ONLY TO THE FRAME AND THE BRACE. DO NOT NAIL ANY PLASTIC DIRECTLY TO THE WOOD.** All flaps must turn freely on their pivot-wires.

If any flap, when closed, overlaps the flap below it by more than 1 in., trim off the excess so that it overlaps by only 1 in.

b. Screw (or nail, if screws are not available) the upper halves of the hinges onto the horizontal support board on which the KAP will swing. (A 1-in.-thick board is best,  $3\frac{1}{2}$  in. wide and at least 12 in. longer than the width of the doorway or other opening in which this KAP is to be installed.)

Be careful to attach the hinges in the UNUSUAL, OUT-OF-LINE POSITION shown in Fig. 12.

**CAUTIONS:** Do NOT attach a KAP's hinges directly to the door frame. If you do, the hinges will be torn loose on its return stroke or on its power stroke.

If you are making a KAP to fit into a rectangular opening, make its frame 4 in. SHORTER than the height of its opening and 1 in. NARROWER than the width of the opening.

c. For this 3-ft model, tie the pull-cord to the center brace about  $12\frac{1}{2}$  in. below the hinge line, as shown in Fig. 12. (If you tie it lower, your arm movements will waste energy.) Use small nails or wire to keep the tie end from slipping up or down on the center brace. (For a more durable connection, see Fig. 22.)

Cut a slot in the flap above the connection of the pull-cord to the vertical brace, deep enough so that this flap will close completely when the KAP is being pulled. Tape the end and edges of the slot.

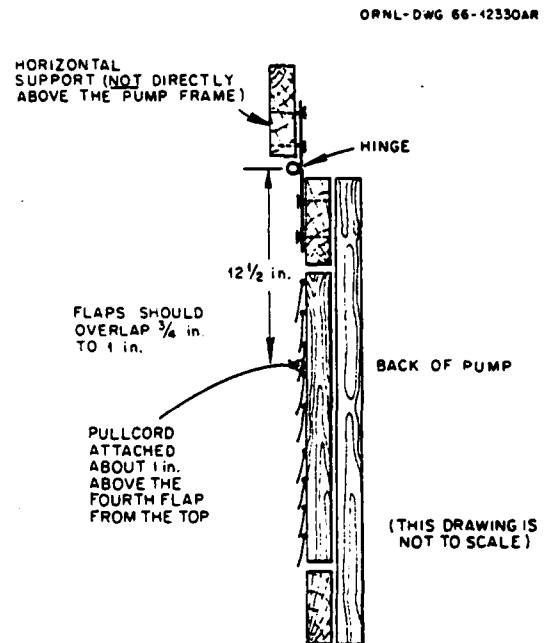


Fig. 12. Hinge is attached so pump can swing 180 degrees.

### IV. MORE RAPID CONSTRUCTION

(Skip this section if you cannot easily get chicken wire and  $\frac{1}{4}$ -in.-thick boards.)

If chicken wire and boards about  $\frac{1}{4}$  in. thick are available, use the chicken wire for flap-stops. By using these materials, the time required to build a given KAP can be reduced by about 40%. One-inch woven mesh is best. (Hardware cloth has sharp points and is unsatisfactory.)

Figure 13 illustrates how the mesh wire should be stapled to the KAP frame. Next, unless the KAP is wider than 3 ft, the front of the whole frame (except for the center brace) should be covered with thin boards approximately  $\frac{1}{2}$  in. thick, such as laths. Then the pivot-wires, with their flaps on them, should be stapled onto the  $\frac{1}{4}$ -in.-thick boards. This construction permits the flaps to turn freely in front of the chicken-wire flap-stops.

With this design, the center of each pivot-wire should NOT be connected to the center brace, nor should the center of the flap be notched. However, pivot-wires that are attached this way must be made and held straighter than pivot-wires used with flap-stops made of straight strings or wires.

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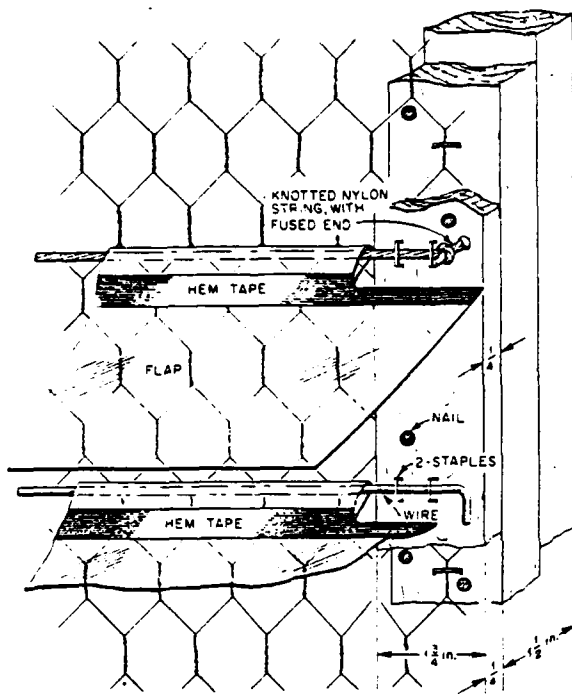


Fig. 13. Flaps attached  $\frac{1}{4}$  inch in front of chicken wire used for flap-stops.

Note in Fig. 13 that each pivot-wire is held firm and straight by 2 staples securing each end. The wire used should be at least as springy as coat hanger wire. If string is used instead of wire, nylon cord about the diameter of coat hanger wire is best for the pivot-strings.

If the KAP is wider than 3 ft, its center vertical brace should also be covered with a  $\frac{1}{4}$ -in.-thick board, and each pivot-wire should be attached to it. Furthermore, the center of each flap should be notched.

## V. INSTALLATION AND ACCESSORIES

### A. Minimum Open Spaces Around a KAP

To pump its maximum volume, an air-supply KAP with good metal hinges should be installed in its opening so that it swings only about  $\frac{1}{2}$  in. above the bottom of the opening and only  $\frac{1}{2}$  in. to 1 in. from the sides of the opening.

### B. Adequately Large Air Passageways

When using a KAP as an air-supply pump to force air through a shelter, it is essential to provide a low-resistance air passageway all the way through the shelter structure from an outdoor air-intake opening for outdoor air to a separate air-exhaust opening to the outdoors (see Fig. 14).

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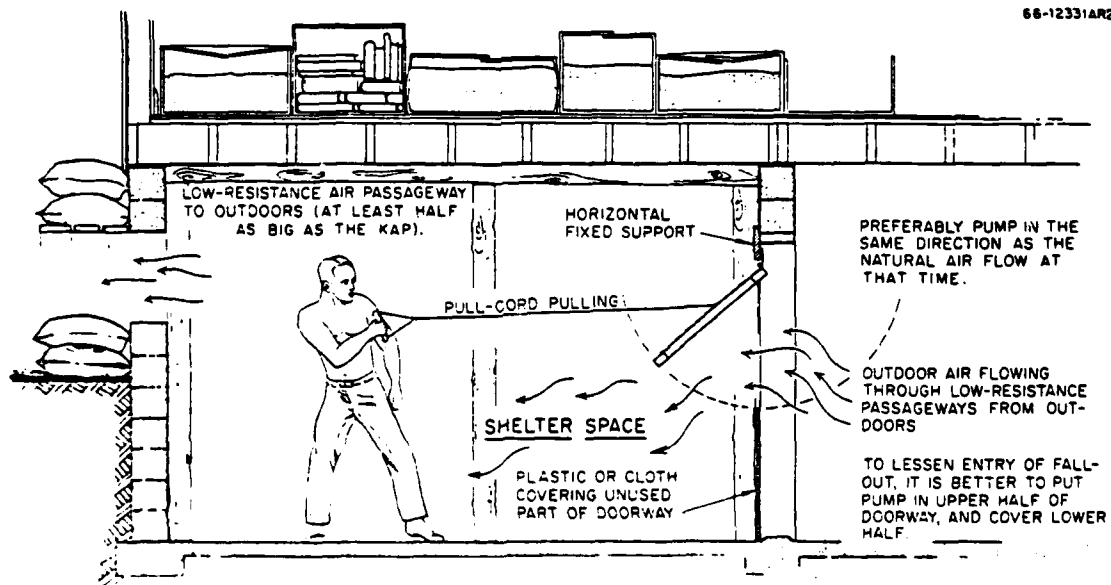


Fig. 14.

A low-resistance air passageway is one that is no smaller in cross-sectional area than half the size of the KAP pumping the air. For example, a  $36 \times 29$ -in. KAP should have a passageway no smaller than about  $3 \frac{1}{2}$  sq. ft. An air-supply KAP of this size will force at least 1000 cubic feet per minute (1000 cfm) through a shelter having such openings, if it is installed as illustrated in Fig. 14.

If smaller air passageways or air-exhaust openings are provided, the volume of air pumped will be greatly reduced. For example, if the air-exhaust opening is only  $1 \frac{1}{4}$  sq. ft. ( $\frac{1}{4}$  the size of this KAP), then this KAP will pump only about 500 cfm. And if the air-exhaust opening is only a  $6 \times 6$ -in. exhaust duct ( $\frac{1}{4}$  sq. ft), then this same  $36 \times 29$ -in. KAP will pump only about 50 cubic feet per minute. This would not provide enough outdoor air for more than one shelter occupant in a well-insulated shelter under heat-wave conditions in the hottest humid parts of the United States. In contrast, when the weather is freezing cold and the shelter itself is still cold enough to absorb the heat produced by the shelter occupants, this same  $6 \times 6$ -in. exhaust duct and the air-intake doorway will cause about 50 cfm of outdoor air to flow by itself through the shelter without using any pump. The reason: body heat warms the shelter air, and the warm air rises if cold air can flow in to replace it. Under these cold conditions—provided the air is distributed evenly throughout the shelter by KAP

or otherwise—50 cfm is enough outdoor air for about 17 people.

To provide adequately large air passageways for air-supply KAPs used to ventilate shelters in buildings, in addition to opening and closing doors and windows, it may be necessary to build large ducts (as described below). Breaking holes in windows, ceilings, or walls is another way to make large, efficient air passageways.

Figure 15 illustrates how a 3-ft KAP can be used as a combined air-supply and air-distribution pump to adequately ventilate a small underground shelter that has an exhaust opening too small to provide enough ventilation in warm weather. (A similar installation can be used to ventilate a basement room having only one opening, its doorway.) Note how, by installing a "divider" in the doorway and entryway, the single entryway is converted into a large air-intake duct and a separate, large air-exhaust duct. To obtain the maximum increased volume of fresh outdoor air that can be pumped through the shelter—a total of about 1000 cfm for a  $36 \times 29$ -in. KAP—the divider should extend about 4 ft horizontally into the shelter room, as shown in Fig. 15. The 6 ft at the end of the divider (the almost-horizontal part under the KAP) can be made of plywood, provided it is installed so that it can be taken out of the way in a few seconds.

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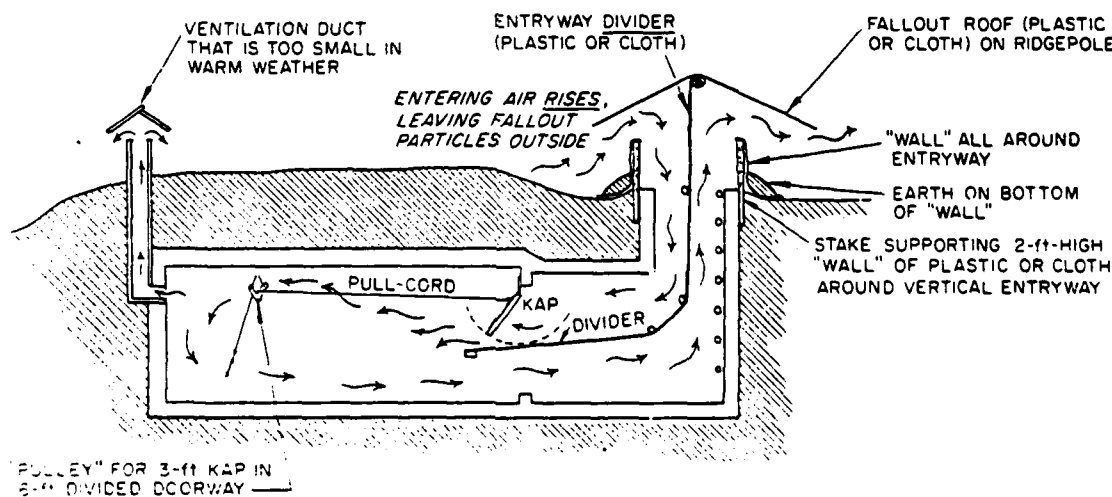


Fig. 15. Ventilating a shelter when the air-exhaust opening is too small.

Note how the entry of fallout into a shelter can be minimized by covering the entryway with a "roof" and by forcing the slow-moving entering air to rise over an obstruction (the "wall") before it flows into the shelter. The sand-like fallout particles fall to the ground outside the "wall."

### C. Adequate Distribution of Air Within the Shelter

To make sure that each shelter occupant gets a fair share of the outdoor air pumped through the shelter, air-distribution KAPs should be used inside most large shelters. These KAPs are used within the shelter, separate from and in addition to air-supply KAPs (see Fig. 16). Air-distribution KAPs can serve in place of both air-distribution ducts and cooling fans. For these purposes, one or more 3-ft-high KAPs hung overhead from the shelter ceiling are usually most practical. If KAPs cannot readily be hung from the ceiling, they can be supported on light frames made of boards or metal, somewhat like those used for a small child's swing.

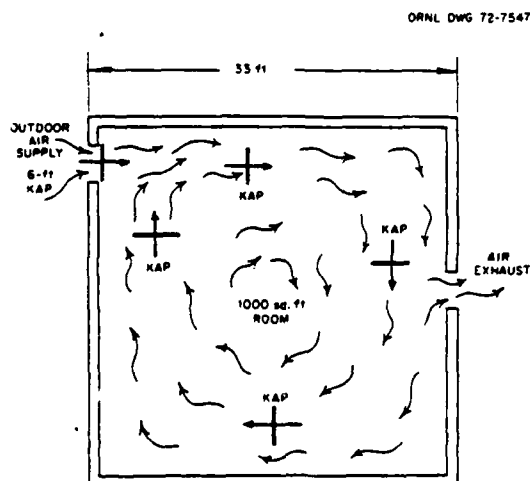


Fig. 16. The use of air-distribution KAPs.

You should make and use enough KAPs to cause air movement that can be felt in all parts of your shelter. Remember that if KAPs are installed near the floor and the shelter is fully occupied, the occupants' bodies will partially block the pumped airflow more than if the same KAPs were suspended overhead.

As a general rule, for shelters having more than about 20 occupants, provide one 3-ft air-distribution

KAP for every 25 occupants. In relatively wide shelters, these interior KAPs should be positioned so that they produce an airflow that circulates around the shelter, preventing the air that is being pumped into the shelter from flowing directly to the exhaust opening. Figure 16 illustrates how four KAPs can be used in this way to distribute the air within a shelter and to fan the 100 occupants of a 1000-sq.-ft shelter room. Avoid positioning an air-distribution KAP so that it pumps air in a direction greater than a right angle turn from the direction of airflow to the location of the KAP.

### D. Operation with a Pulley

A small KAP—especially one with improvised hinges or one installed at head-height or higher—can be pulled most efficiently by running its pull-cord over a pulley or over a greased homemade "pulley" such as described in Figs. 17 and 18. A pulley should be hung at approximately the same height as the hinges of the KAP, as illustrated in Fig. 15. To make

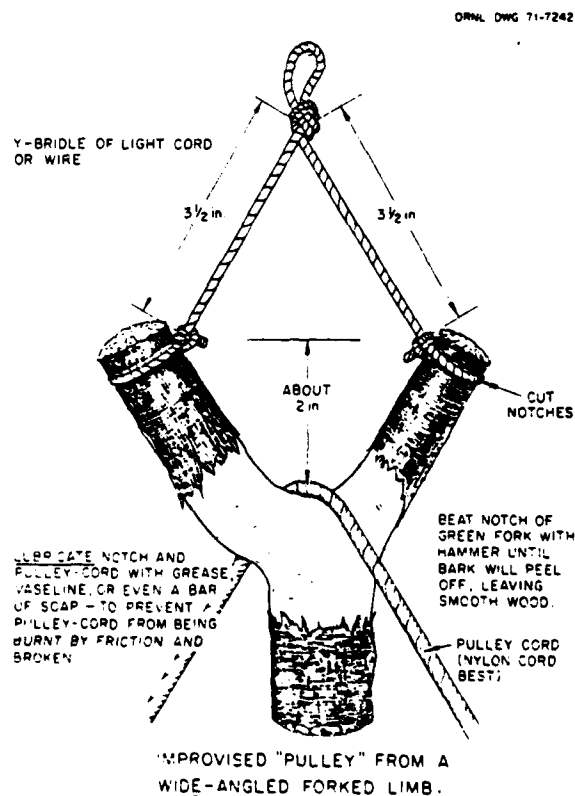


Fig. 17.

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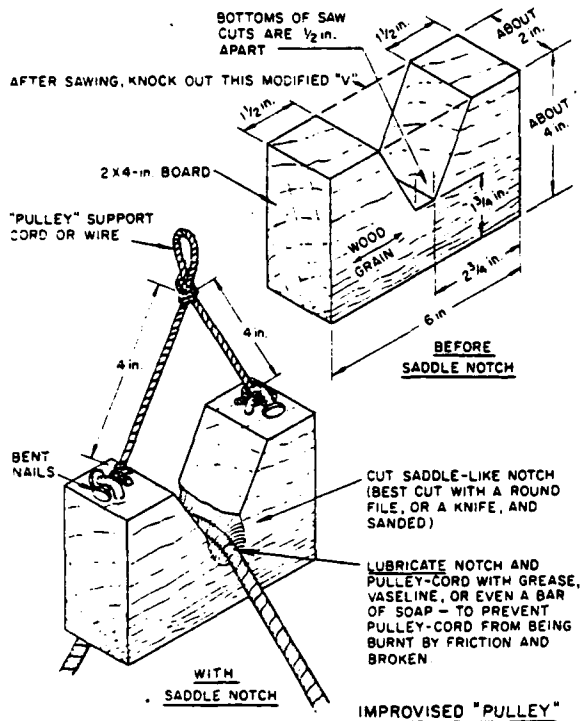


Fig. 18.

a comfortable hand-hold on which to pull downward, tie two or three overhand knots in a strip of cloth on the end of the pull-cord.

(Such a "puiley" can also be used to operate a bail-bucket to remove water or wastes from some shelters, without anyone having to go outside.)

#### E. Quick-Removal Brackets

The air-supply KAP that pumps air through your shelter is best held in its pumping position by mounting it in homemade quick-removal brackets (see Fig. 19) for the following reasons:

- A KAP provided with quick-removal brackets can be taken down easily and kept out of the way of persons passing through its doorway when it is not in use. It can be kept in a place where people are unlikely to damage it.
- By installing two sets of quick-removal brackets in opposite shelter openings, you can quickly reverse the direction in which the KAP pumps air, to take

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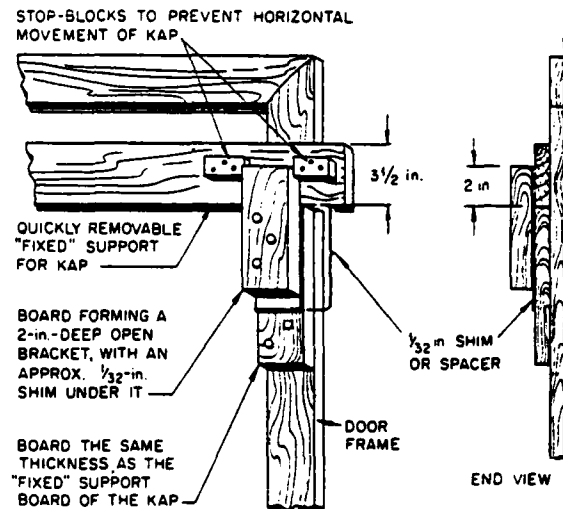


Fig. 19. Quick-removal bracket for KAP.

advantage of changes in the direction of natural airflow through the shelter.

• If the KAP is installed on quick-removal brackets, in an emergency a person standing beside the KAP could grasp its frame with both hands, lift it upward a few inches to detach it, and carry it out of the way—all in 3 to 5 seconds. Being able to move the KAP quickly could prevent blast winds from wrecking the pump, which might also be blown into your shelter—possibly injuring occupants. In extensive areas where fallout shelters and their occupants would survive the blast effects of typical large warheads, more than 4 seconds would elapse between the time shelter occupants would see the extremely bright light from the explosion and the arrival of a blast wave strong enough to wreck a KAP or other pumps left exposed in a ventilation opening.

Note in Fig. 19 that the KAP's "fixed" support-board (a 3 1/2-in.-wide board to which its hinges are attached) is held in a bracket only 2 inches deep. To prevent too tight a fit in the bracket, be sure to place a 1/32-in. shim or spacer (the cardboard back of a writing tablet will do) between two boards of the bracket, as illustrated. Also, make spaces about 1/16 inches wide between the lower inner corners of the stop-blocks and the sides of the outer board. To prevent your hands from being cut, you should put tape over the exposed ends of wires near the frame's outer edges of a KAP that you want to be able to remove rapidly.



In a small expedient shelter, a small KAP can be quickly jerked loose if its "fixed" support-board is attached to the roof with only a few small nails.

## VI. OPERATION AND MAINTENANCE

### A. Pumping

Operate your 3-foot KAP by pulling it with an easy, swinging motion of your arm. To pump the maximum volume of air, you should pull the KAP toward you until its frame swings out to an almost-horizontal position. Then quickly move your hand so that the pull-cord is kept slack during the entire, free-swinging return stroke. Figure 24 in Section VIII, LARGE KAPs, illustrates this necessary motion.

Be sure to provide a comfortable hand-hold on the pull-cord (see Fig. 14). Blisters can be serious under unsanitary conditions.

To pull a KAP via an overhead pulley with minimum effort, sit down and pull as if you were tolling a bell—except that you should raise your hand quickly with the return stroke and keep it raised long enough so that the pull-cord remains slack during the entire return stroke. Or, if the pulley is not overhead, operate the KAP by swinging your extended arm back and forth from the shoulder.

### B. Placement to Take Advantage of the Natural Direction of Air Flow

A KAP can pump more air into a shelter if it is installed so that it pumps air through the shelter in the direction in which the air naturally flows. Since this direction can be reversed by a wind change outdoors, it is desirable to provide a way to quickly remove your pump and reposition it so that air can be pumped in the opposite direction. This can be done in several ways, including making one set of quick-removal brackets for one air opening and a second set for the other.

### C. Maintenance

To operate your KAP efficiently, keep the flaps in good repair and make sure that there is the minimum practical area of open spaces in and around the KAP through which air can flow back around the pump frame, opposite to the pumped direction. So keep at least some extra flap material in your shelter, along with some extra tape and the few tools you may need to make repairs.

## VII. NARROW KAPs AND SMALL KAPs

### A. Narrow KAPs

To swing efficiently in an entrance or emergency exit of an expedient trench shelter that is 22 in. wide, a KAP is best made 20 in. wide and 36 in. high. One of less height is not as efficient as a 36-in.-high model and has to be pulled uncomfortably fast. So, when ventilation openings can be selected or made at least 38 in. high, make your pump 36 in. high.

In a narrow trench shelter, it is best to have the pull-cord run the full length of the trench, along the trench wall that occupants will face when sitting. Then each occupant can take a turn pulling the pump without having to change seats.

Good metal hinges on a narrow KAP allow it to swing properly if pulled with the pull-cord attached to one side of the frame. (Pumps with improvised hinges and large pumps must be pulled from a connection point on their center vertical brace to make them swing properly.) Therefore, if you have small metal hinges and need a KAP no wider than 20 inches, build a rectangular frame without a vertical center brace. Make two pull-cord attachment points, one on each side of the frame and each 9 inches below the top of the frame. (For a small KAP, a satisfactory attachment point can readily be made by driving two nails so that their heads cross, and wiring them together.) Then if a change in wind direction outside causes the direction of natural air flow in the trench to become opposite to the direction in which air is being pumped, you can move your KAP to the opening at the other end of the trench. The pull-cord can easily be connected to the other side of the frame, and convenient pumping can be resumed quickly.

So that the horizontal support board can be nailed easily to the roofing poles or boards of an entry trench, it is best to use cabinet hinges. Screw them onto an edge of the support board, in the UNusual, OUT-OF-LINE POSITION shown in Fig. 20. This hinge connection allows the pump to swing a full 180 degrees. To facilitate moving the horizontal support board, connect it to the roof with a few small nails, so that it can be pulled loose easily and quickly.

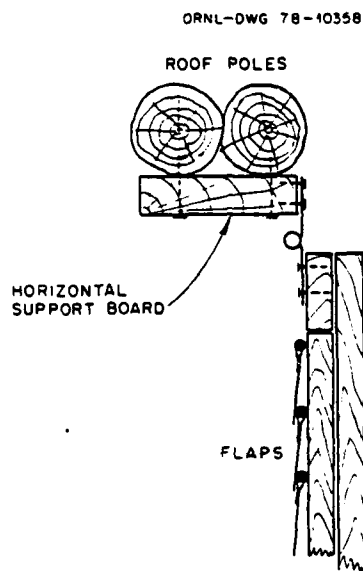


Fig. 20.

### B. Small KAPs

If the only available opening in which a KAP can be installed is small, build a KAP to fit it. Use narrower boards to make the frame and make the flaps of thinner material, such as the polyethylene of large plastic trash bags. For pumps 24 inches or less in height, make the finished flaps only  $3\frac{1}{2}$  inches wide and space their pivot-wires 3 inches apart. The flaps should overlap no more than  $\frac{1}{2}$  inch. A KAP 24 inches high will pump enough outdoor air for only a few people, except in cold weather.

Small, yet efficient KAPs can be made even if the only materials available are straight sticks about  $1\frac{1}{4}$  inches in diameter, strips of cloth to tie the frame together and to make the hinges and the pull cord, polyethylene film from large trash bags for the flaps, freezer or duct tape (or needle and thread) to make the flap hems, coat hanger wire or string for the pivot-wire, and string or ordinary thread for the flap-stops. A sharp knife is the only essential tool. Figure 21 shows a way to easily tie sticks securely together and to attach strings or threads for stop-flaps, when small nails and tacks are not available. The flap-stop strings or threads should be secured by wrapping them several times around each stick to which they are attached, so they will be gripped by the out-of-line knife cuts.

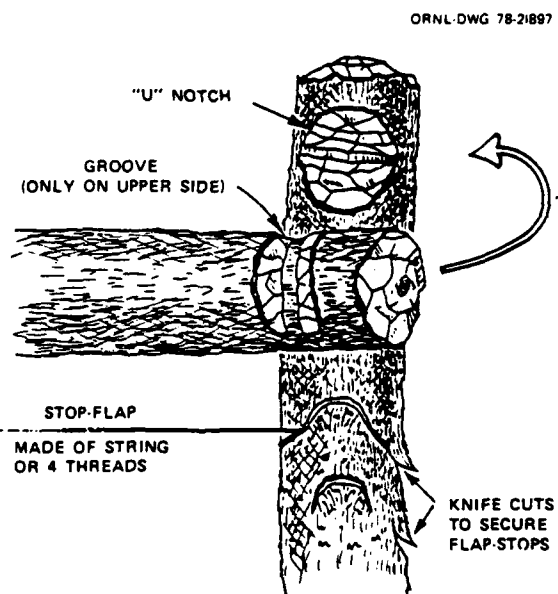


Fig. 21. Sticks ready to be tied together to make a KAP frame.

## APPENDIX B

### Construction of an Improvised Shelter

If a nuclear attack on the United States appeared imminent, people who had no public shelter available and had not made advance preparations in their homes could still improvise shelter protection. Improvised shelters could save tens of millions of lives.

In low-risk areas, the best place to improvise a shelter would be a home basement or a storm cellar, if one existed.

In high-risk areas (cities of about 50,000 population or greater, or areas near an important military base), it would be advisable to build an outdoor "expedient" shelter, as described in this article. An expedient shelter (for example, an earth-covered trench in the backyard) can provide considerable blast protection--as well as excellent protection against fallout.

#### Materials

To improvise a shelter, radiation shielding materials would be needed such as concrete blocks, bricks, sand, etc. Other things that could also be used as shielding material, or to support shielding material, include:

1. House doors that have been taken off their hinges, especially heavy outside doors. (If weak, hollow-core doors are used, it is advisable to use a double layer of doors.)
2. Dressers and chests. (Fill the drawers with sand or earth after they are placed in position, so they won't be too heavy to carry.)
3. Trunks, boxes, and cartons. (Fill them with sand or earth after they are placed in position.)
4. Tables and bookcases.
5. Large appliances, such as washers and dryers.
6. Books, magazines, and stacks of firewood or lumber.
7. Flagstone from outside walks and patios.

### Improvising a Basement Shelter

Here are two ways of improvising fallout protection in the basement of a home:

1. Using a table or workbench. Set up a large, sturdy table or workbench in the basement corner that is most below ground level. On the table, pile as much shielding material as it will hold without collapsing. Around the table place as much shielding material as possible, up as high as the table top. When family members are "inside the shelter"--that is, under the table--block the opening with other shielding material. Remember, the more earth or other heavy shielding material you use, the better the protection will be.
2. Using furniture and house doors. If there is no large table or workbench available, or if more shelter space is needed, place furniture or large appliances in the corner of the basement to serve as the "walls" of the shelter.

As a "ceiling," use doors from the house that have been taken off their hinges. On top of the doors, pile as much shielding material as they will support. Stack other shielding material around the "walls" of the shelter. When everyone is inside the shelter space, block the opening with shielding material.

### A Storm Cellar Can be a Shelter

A below-ground storm cellar can be used as an improvised fallout shelter, but additional shielding material may be needed to provide adequate protection from fallout radiation.

If the existing roof of the storm cellar is made of wood or other light material, it should be covered with at least 1 to 2 feet of earth or an equivalent thickness of other shielding material. More posts or braces may be needed to support the extra weight. Again, the more earth you use, the better the protection will be. But make sure the roof can support the weight of the earth.

After the roof has been shielded, and all occupants are in the shelter, better protection can be provided by blocking the entrance way (inside) with 8-inch concrete blocks or an equivalent thickness of sandbags, bricks,

earth, or other shielding material. A few inches should be left open at the top for air. After fallout particles have stopped coming down the outside door of the storm cellar may be left open to provide better ventilation.

If shielding material is not available for the entrance way, shelter occupants should stay as far away from the entrance as possible. They also should raise the outside door of the storm cellar now and then to knock off any fallout particles that may have collected on it.

#### Using the Crawl Space Under a House

Some homes without basements have "crawl space" between the first floor and the ground underneath the house. If such a house is set on foundation walls rather than on pillars, fallout protection may be improvised in this space.

Access to the crawl space should be created through the floor or the outside foundation wall, perhaps by building a trapdoor or other entry before an emergency occurs. As the location for the shelter, select a crawl space area that is under the center of the house, as far away from the outside walls as possible.

Around the selected shelter area, place shielding material--preferably bricks or blocks, or containers filled with sand or earth--from the ground level up to the first floor of the house, so that the shielding material forms the "walls" of the shelter area. On the floor above, place other shielding material to form a "roof" for the shelter area.

Use at least 1 to 2 feet of earth (in boxes or dresser drawers), or other heavy material. The more shielding you put overhead, the better the protection.

If time permits, dig out more earth and make the shelter area deeper, to allow for standing erect or at least sitting up.

### Improvising an Outside "Expedient" Shelter

If a home has no basement, no storm cellar, and no protected crawl space, it is possible to improvise protection outside.

Designs are shown at the end of this article for several types of "expedient" shelter. These are shelters that can be built outdoors, using locally-available materials.

Simpler types of expedient shelters may use doors from inside a house, taken off their hinges and used (for example) to cover a trench dug in a backyard. Other types need more material--for example, logs or lumber--but result in a somewhat larger and less uncomfortable shelter.

Outdoor "expedient" shelters can provide a considerable degree of blast protection, as well as excellent fallout protection. Thus, constructing an expedient shelter is advisable if you live in a risk area (a city of about 500,000 population or greater, or near an important military base).

### Improving Protection of Larger Buildings

Also shown, at the end of this article, are ways to improve the fallout protection of larger buildings. This involves adding earth alongside and on top of buildings such as schools or stores. These techniques could be needed if crisis relocation plans were activated, and it became necessary to provide protection for groups of evacuees, in smaller towns outside of risk areas.

### Boats as Improvised Shelters

A boat with an enclosed cabin could be used as a fallout shelter.

In addition to emergency supplies such as food, drinking water, and a battery-powered radio, items needed aboard include a broom, bucket,

or pump-and-hose to sweep off or flush off fallout particles that might collect on the boat.

The boat should be anchored or cruised slowly at least 200 feet off-shore, where the water is at least 5 feet deep. This distance from shore would protect occupants from radioactive fallout particles that had fallen on the nearby land. A 5-foot depth would absorb the radiation from particles falling into the water and settling on the bottom.

If particles drift down on the boat, stay inside the cabin most of the time. Go outside now and then, and sweep or flush off any particles that have collected on the boat.

#### Expedient Shelters

More detailed plans for expedient shelters have been developed, and have been tested. In actual field-tests, average American families have successfully built each of the types of expedient shelter shown here, using only simple hand tools and the instructions shown. (Having work gloves available was very important.)

The time required ranged from about 8 hours for the simplest shelter (2 persons working 8 hours each, for the car-over-trench shelter), to about 12 to 18 hours for the more elaborate shelters.

Outdoor expedient shelters can provide excellent fallout protection, and a considerable degree of blast protection as well. Thus, an outdoor expedient shelter may be appropriate if you live in or near a risk area (a city of about 50,000 or greater population, or near an important military base).

Also included is general information on making the shelter livable; and directions for making a simple air-ventilation pump, an emergency lamp, and a bucket stove.

### Modifying Larger Buildings to Improve Fallout Protection

The fallout protection of larger buildings can also be improved by adding earth--both alongside the building and overhead.

In a situation where crisis relocation (evacuation) plans were executed, there could be large numbers of evacuees in the smaller towns surrounding the larger high-risk cities. These evacuees would need fallout protection, and in many cases the best solution would be to improve the fallout protection of schools, stores, and other buildings.

The two illustrations following show the concept of adding earth to improve fallout protection. Note that the illustrations indicate that some buildings may need strengthening, to assure that they can support the added weight of a number of tons of earth placed overhead. A qualified engineer or builder would need to advise local officials on which buildings would need such strengthening, before attempting to improve their fallout protection by adding earth.

Operations to provide fallout protection for groups of people, in larger buildings, would require mobilizing dozers and other heavy equipment to move earth. However, evacuees might be asked to help too--in the same way that citizens are sometimes asked to help fill sandbags when a flood threatens.

### Construction of an Expedient Shelter

Without protection, untold numbers of Americans would die needlessly in the event of a nuclear attack. The expedient shelters illustrated in the following pages provide protection to occupants from the deadly radiation of radioactive fallout generated by a nuclear detonation--their use can save the lives of millions of Americans.

Even though the illustrated shelters are very austere, there are a number of things that can be done to improve their habitability after they



have been built. With the use of a little ingenuity and effort, the shelters can be made more comfortable. Some of the things that can be done are:

1. Construct seats, hammocks, or bunks.
2. Cover the floor with boards, pine boughs, or logs and drape sheets or material over the earth walls.
3. Provide safe, dependable light.
4. For hot water, construct the expedient air ventilation pump.
5. For cooking, construct the expedient cook stove for use in the entryway. In cold weather, seal the entrance and use the stove for heating the shelter area. Be sure ventilation is provided whenever the stove is used.

Humans must have water and food to live. When people are to live in a shelter for a week or two, sufficient food and supplies must be provided for the occupants. The minimum necessities are:

1. Water--Minimum requirements (dependent upon temperature--less in cold weather, more in warmer) will be from one quart to one gallon per person per day. Storage can be accomplished by using disinfected metal or plastic trash cans or boxes lined with strong polyethylene film or strong plastic bags. For purity, eight drops (one teaspoon) of a 5% chlorine solution (e.g., Clorox) should be mixed into each 5 gallons of water.
2. Food--All food should require no refrigeration and should be brought to the shelter in airtight tins or bottles. Under shelter conditions, people will require about half as much food as usual. Foods should have a high nutritional value and a minimal amount of bulk (i.e., canned meats--fruits--vegetables, dried cereals, hard candy, etc.).
3. Sanitation--A metal container with a tight-fitting lid for use as a toilet with which plastic bags can be used. Toilet paper, soap, towels, sanitary items, and a quantity of strong plastic bags will be needed.
4. Medical Supplies--A well-stocked first-aid kit comparable to what is usually kept at home. Take special medicines for infants and others and a good first-aid handbook.
5. Clothing and Bedding--Several changes of clean clothing, especially socks and underclothing--dependent upon the weather, blankets, pillows and sleeping bags may also be needed.

6. Portable Radio--Lastly, but hardly least important, a portable radio with fresh and extra batteries. Radio station broadcasts will advise you when it is safe to abandon the shelter and also provide you with other important emergency information.

# EXPEDIENT FALLOUT SHELTER

## CAR-OVER-TRENCH

**GENERAL INFORMATION:** READ AND STUDY ALL INSTRUCTIONS BEFORE BEGINNING. IF A BIG STATION WAGON IS USED, SHELTER CAN BE PROVIDED FOR UP TO 6 PERSONS. LESS IF CAR IS SMALLER. THIS SHELTER CAN NOT BE BUILT IN AREAS WHERE GROUNDWATER OR ROCK IS CLOSE TO THE GROUND SURFACE. SHELTER CAN BE CONSTRUCTED BY TWO PERSONS WORKING A TOTAL OF ABOUT 8 HOURS EACH.

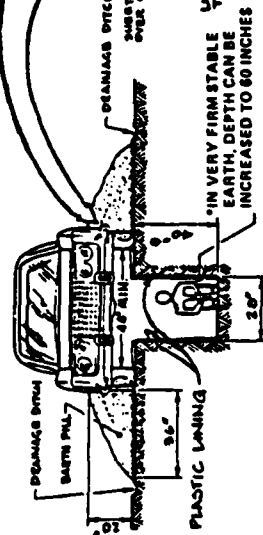
### STEP 1

SELECT A LEVEL SITE. DIG A SMALL TEST HOLE ABOUT 10 INCHES DEEP. REMOVE ALL LOOSE EARTH FROM THE BOTTOM. PUSH THE POINT OF YOUR THUMB INTO THE UNDISTURBED EARTH IN THE BOTTOM OF HOLE. IF YOU CANNOT PUSH YOUR THUMB DEEPER THAN ONE INCH, THE EARTH SHOULD BE SUITABLE FOR THIS SHELTER. IF THUMB PENETRATES DEEPER THAN ONE INCH, MOVE TO ANOTHER SITE AND REPEAT TEST. BECAUSE EARTH AT THE TESTED SITE IS NOT SUITABLE.



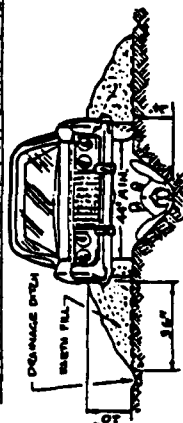
### STEP 2

STAKE OUT DIMENSIONS SHOWN FOR TRENCH AND ENTRYWAY. NOTE THAT THE LENGTH OF TRENCH MUST BE 4 FEET LESS THAN THE OVERALL LENGTH OF THE CAR.



### TRENCH AND FILL DETAIL

#### ALTERNATIVE METHOD FOR SANDY SOILS



A "SIT IN" SHELTER CANNOT BE DUG IN BEACH TYPE SAND, BECAUSE THE TRENCH WALLS WILL CAVE IN. HOWEVER, A "LIE IN" TRENCH CAN BE DUG AS SHOWN ABOVE AND STILL PROVIDE GOOD FALL-OUT PROTECTION. ALL OTHER STEPS REMAIN THE SAME.

### TOOLS AND MATERIALS

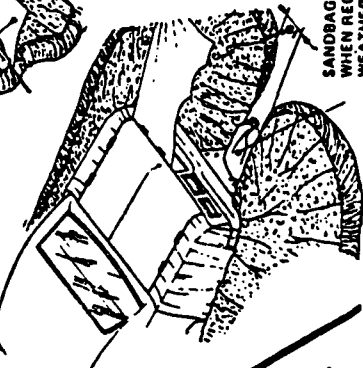
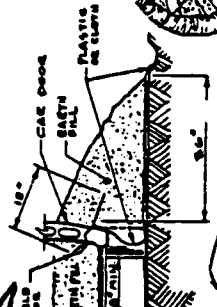
1. CAR: CAUTION: CAR MUST HAVE AT LEAST 44 INCHES OF WIDTH BETWEEN INSIDE WALLS OF TIRES.
2. PICK AND LONG-HANDLED SHOVEL.
3. PLASTIC SHEETING AND/OR CLOTH APPROX. 10-12 BEDSHEETS OR EQUIV. AREA OF OTHER MATERIALS WILL BE REQUIRED.
4. SANDBAGS, SACKS OR PILLOWCASES, 9 REQUIRED.
5. 50 FEET OF STRONG STRING OR CORD AND A KNIFE.
6. YARDSTICK OR MEASURING TAPE.
7. WORK GLOVES FOR EACH WORKER.
8. STAKES, 4 REQUIRED.

### STEP 3

EXCAVATE TRENCH AND ENTRYWAY. AS TRENCH DEEPENS, REPEAT EARTH STABILITY TEST ON BOTTOM OF TRENCH. IF EARTH BECOMES "SOFTER" DO NOT DEEPEN TRENCH. PLACE EXCAVATED EARTH AWAY FROM TRENCH SO THAT CAR CAN BE DRIVEN OVER TRENCH.

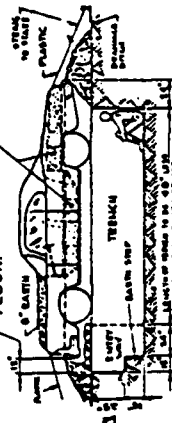
### STEP 4

LINE TRENCH WITH PLASTIC OR CLOTH. LINING SHOULD TOUCH FLOOR OF TRENCH AND EXTEND OUTWARD TO THE LIMIT OF EARTH FILL. AFTER TRENCH IS LINED, CAREFULLY DRIVE CAR OVER TRENCH TO THE POSITION SHOWN. HAVE SOMEONE GUIDE THE DRIVER OVER THE TRENCH.



SANDBAG TO REDUCE AIRFLOW WHEN REQUIRED DURING COLD WEATHER

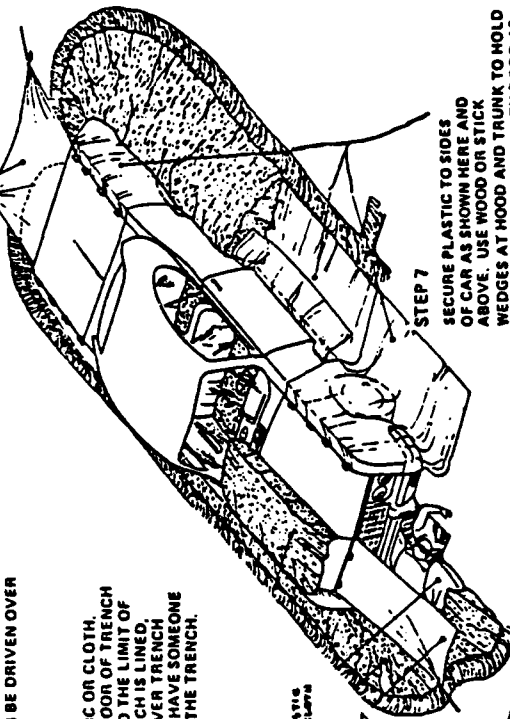
- STEP 5 REMOVE ALL SEATS (IF POSSIBLE). COVER FLOOR AND TRUNK WITH PLASTIC; PLACE 1 FOOT OF EARTH FILL IN TRUNK AND ON FLOOR.



### TRENCH AND ENTRYWAY DETAIL

### STEP 6

PLACE PLASTIC COVER OVER ENTRANCE AND VENTILATION OPENINGS. SECURE UNDER HOOD AND TRUNK LID.



### STEP 7

SECURE PLASTIC TO SIDES OF CAR AS SHOWN HERE AND ABOVE. USE WOOD OR STICK WEDGES AT HOOD AND TRUNK TO HOLD PLASTIC. ALSO SECURE WITH DOOR AS SHOWN ABOVE.

### STEP 8

BANK EARTH AROUND CAR TO HEIGHT OF 20 INCHES

### STEP 9

PLACE SANDBAGS AROUND ENTRANCE AND BANK EARTH AROUND THEM.

### STEP 10

PLACE 8 INCHES OF EARTH ON CAR HOOD

### STEP 11

DIG SHALLOW DRAINAGE DITCH AROUND FILL.

## DOOR COVERED TRENCH SHELTER

THIS SHELTER IS DESIGNED FOR AREAS WHERE THERE IS A SHORTAGE OF SMALL TREES AND/OR BUILDING MATERIALS. THE DEPTH TO GROUND WATER AND ROCK MUST ALSO BE BELOW THE BOTTOM OF THE TRENCH. IN ADDITION, THE EARTH MUST BE SUFFICIENTLY FIRM AND STABLE SO THAT THE TRENCH WALLS WILL NOT COLLAPSE. THE SHELTER (3 PERSON CAPACITY) CAN BE CONSTRUCTED BY 3 PEOPLE WORKING AN APPROXIMATE TOTAL OF 12 HOURS EACH. READ AND STUDY ALL INSTRUCTIONS BEFORE BEGINNING TO BUILD.

**SELECT A REASONABLY LEVEL SITE. LAY OUT THE SHELTER AS ILLUSTRATED BY LAYING DOORS SIDE BY SIDE TO DETERMINE THE SHELTER LENGTH. DOOR KNOBS SHOULD BE REMOVED.**

[illegible]

1. The Commission is not required to provide a written report to the President and the Senate.

**STEP 4** IN ORDER TO HOLD IN PLACE AN ADEQUATE AMOUNT OF EARTH ON TOP OF THE DOORS, CONSTRUCT EARTH "ROLLS" AROUND THE ENTRY. WAY AS SHOWN, THE "ROLLS" WILL KEEP THE EARTH FILL IN PLACE. SEE HOW TO MAKE AN EARTH ROLL.

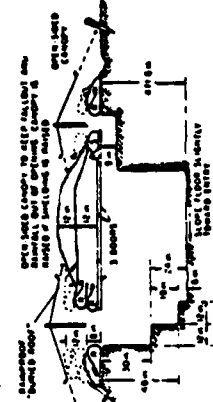
**STEP 6 CONSTRUCT SHALLOW DRAINAGE DITCHES ON ALL SIDES AND PLACE CANOPIES OVER THE OPENINGS.**

1. **DOORS (INTERIOR SOLID OR HOLLOW CORE) – 1 FULL SIZE (32" MINIMUM WIDTH) FOR EACH PERSON. IF DOORS MEASURE LESS THAN 32" IN WIDTH, USE A COMBINATION OF DOORS TO PROVIDE THE MINIMUM WIDTH PER PERSON. IF DOORS ARE HOLLOW CORE-USE TWO LAYERS.**

- ## HOW TO MAKE AN EARTH ROLL

**2. PLACE 2 FT. OF THE LENGTH OF THE CLOTH ON THE GROUND, AS ILLUSTRATED.**

- 
- Diagram illustrating the construction of a trench for a bed. A person is shown using a shovel to place earth fill against a cloth barrier. The diagram includes labels for the cloth, earth fill, and the trench dimensions.
- Labels in the diagram:
- THE CLOTH
  - THE HANDS TO HOLD THE LENGTH OF THE CLOTH
  - EARTH FILL
  - 2'
  - THE TRENCH
  - THE OPENING TO BE 2 FT. WIDER
  - THE LENGTH OF THE TRENCH
  - THE CLOTH
  - THE HANDS TO HOLD THE LENGTH OF THE CLOTH
  - EARTH FILL
  - 2'
  - THE TRENCH
  - THE OPENING TO BE 2 FT. WIDER
  - THE LENGTH OF THE TRENCH



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# EXPEDIENT FALLOUT SHELTER

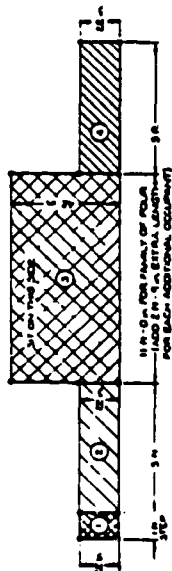
## LOG-COVERED TRENCH SHELTER

### GENERAL INFORMATION

THIS SHELTER IS DESIGNED FOR AREAS WHERE THE DEPTH BELOW THE GROUND SURFACE TO HAND ROCK OR GROUNDWATER IS BELOW THE BOTTOM OF THE TRENCH. ALSO, THE EARTH MUST BE SUFFICIENTLY FIRM AND STABLE SO THAT THE TRENCH SIDEWALLS WILL NOT CAVE IN. IN ADDITION, ADEQUATE SMALL TREES THAT CAN BE CUT FOR LOGS MUST BE AVAILABLE IN THE IMMEDIATE AREA. THE SHELTER (4-PERSON CAPACITY) CAN BE BUILT BY 4 PEOPLE WORKING A TOTAL OF 12 HOURS EACH. AFTER INITIAL COMPLETION, THE SHELTER CAN BE ENLARGED TO A WIDTH OF 5 FT.-8 IN. AND DEEPENED TO 6 FT. HOWEVER, 9-FT LOGS MUST BE USED IN PLACE OF 7-FT LOGS AND THE BURIED ROOF MUST BE LARGE ENOUGH TO COVER THE WIDENED SHELTER DURING THE INITIAL CONSTRUCTION.

#### STEP 1

CLEAR AREA OF BRUSH AND TALL GRASS.  
LAYOUT SHELTER AS SHOWN BELOW.



#### LEGEND



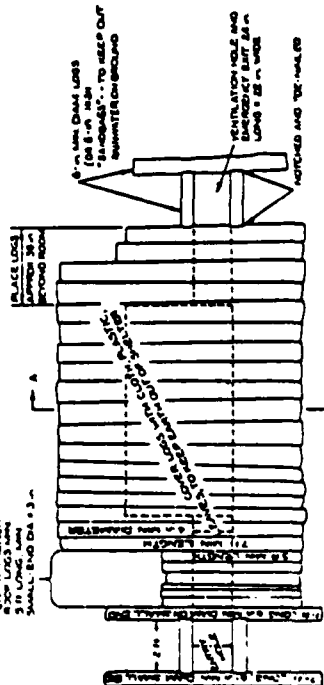
#### STEP 2

BEGIN EXCAVATING THE TRENCH. PLACE EXCAVATED EARTH AT LEAST 3 FEET BEYOND THE EDGE OF TRENCH SO THAT THE ROOF LOGS CAN LATER BE PLACED OVER THE TRENCH.

#### STEP 3

AS THE TRENCH EXCAVATION PROGRESSES, SOME WORKERS SHOULD BEGIN CUTTING LOGS TO THE LENGTH AND SIZE AS SHOWN ON THE ILLUSTRATIONS

ATTENTIVE BE AND SMALL BACKS OF LOGS TO KEEP THEM STRAIGHT ACROSS SHELTER ROOM

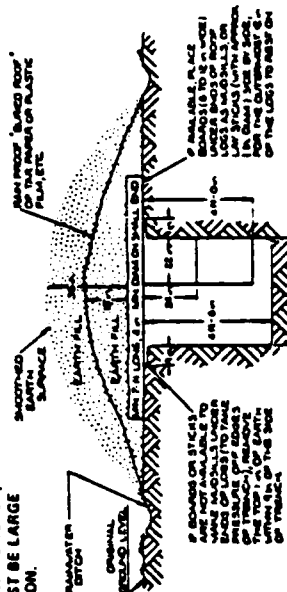


NOTE: LOGS - MINIMUM 1 1/2 IN. DIA. - 12 IN. LONG. UNLESS SHOWN OTHERWISE. UNIFORMED CHARTER ON SMALL END OF LOGS - 1 IN. DIA. EACH END OF SHELTER ROOM

#### PLAN VIEW OF TOP OF SHELTER

#### STEP 4

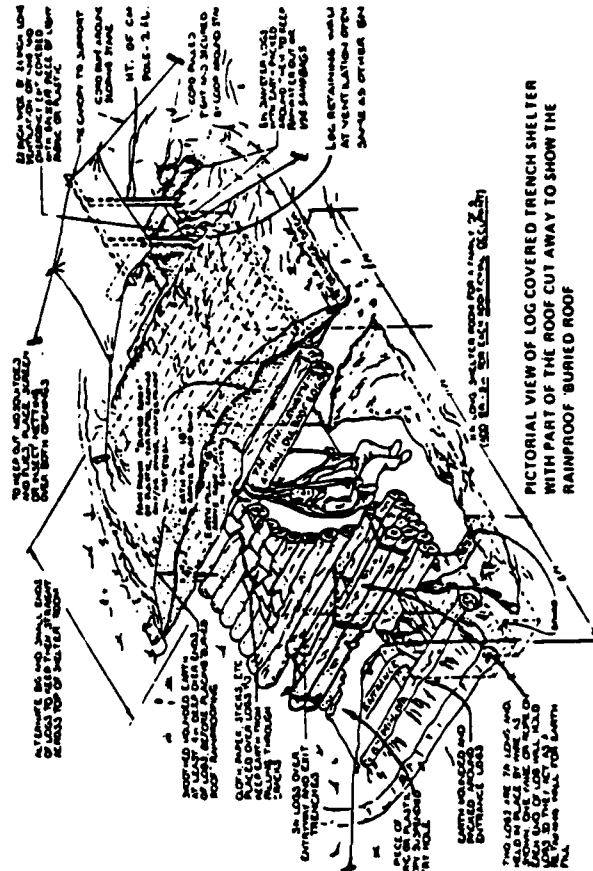
PLACE LOGS OVER TRENCH. POSITION TIES FOR BED SHEET CHAIRS OR HAMMOCKS. PLACE NEWSPAPER OR OTHER MATERIAL AS INDICATED OVER LOGS. PLACE EARTH FILL AND BURIED ROOF.



#### SECTION A-A

#### STEP 5

CONSTRUCT CANOPIES OVER THE OPENINGS



PICTORIAL VIEW OF LOG COVERED TRENCH SHELTER WITH PART OF THE ROOF CUT AWAY TO SHOW THE RAINPROOF BURIED ROOF

#### TOOLS AND MATERIALS

1. SAW AND/OR AXE.
2. PICK OR MATTOCK
3. LONG-HANDED SHOVELS.
4. RAINPROOFING MATERIAL (PLASTIC OR POLYETHYLENE) 25 SQUARE YARDS FOR EACH PERSON ABOVE 4. ADD 250 YDS.
5. 50 FEET OF STRONG STRING OR CORD AND A KNIFE.
6. TAPE MEASURE OR YARD STICK
7. AT LEAST 8 PILLOW CASES AND/OR SACKS.
8. WORK GLOVES.
9. BED SHEETS FOR USE AS "CHAIRS" OR "HAMMOCKS" - 1 PER PERSON PLUS AT LEAST 15 FEET OF STRONG ROPE OR CORD PER BED SHEET.
10. 15 POUNDS OF NEWSPAPERS TO PLACE OVER ROOF LOGS TO KEEP EARTH FROM FALLING THROUGH CRACKS BETWEEN LOGS.

#### APPROX. NO. OF POLES REQ'D.

45 - 7' LONG 4" DIA.

10 - 5' " 4" "

# EXPEDIENT FALLOUT SHELTER

## TILT-UP DOORS AND EARTH

### GENERAL INFORMATION

READ AND STUDY ALL INSTRUCTIONS BEFORE STARTING TO BUILD. THE LOCATION SELECTED FOR THIS SHELTER SHOULD BE LEVEL OR GENTLY SLOPING DOWN AND AWAY FROM THE MASONRY WALL. A THREE PERSON SHELTER CAN BE CONSTRUCTED BY THREE PEOPLE WORKING A TOTAL OF 8 HOURS EACH.

#### STEP 1

LAY OUT THE TRENCH AND EARTH NOTCH WIDTHS, AS DIMENSIONED ON THE SECTION BELOW, ADJACENT TO A MASONRY WALL. DETERMINE THE LENGTH OF TRENCH AND NOTCH BY ALLOWING ONE DOOR WIDTH OF LENGTH PER PERSON TO BE SHELTERED.

#### STEP 2

EXCAVATE TRENCH AND EARTH NOTCH. PLACE EXCAVATED EARTH OUTSIDE SHELTER LIMITS FOR LATER USE.

#### STEP 3

REMOVE DOOR KNOBS FROM ALL DOORS. PLACE DOUBLE LAYER OF DOORS IN NOTCH AND AGAINST WALL AS SHOWN IN SKETCH. NAIL 12" BOARD TO DOOR EDGES AT ENTRANCE TO SERVE AS EARTH STOP. AFTER ATTACHING PLASTIC ENTRANCE COVER AS SHOWN, OR BUILD RETAINING WALL OF SANDBAGS IN LIEU OF BOARD. PLACE ONE DOOR ON EDGE LENGTHWISE AS THE END CLOSURE.

#### STEP 4

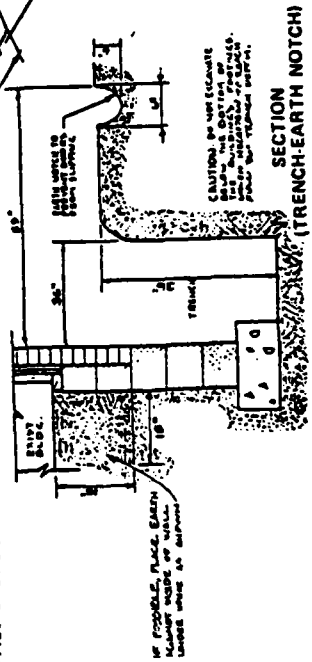
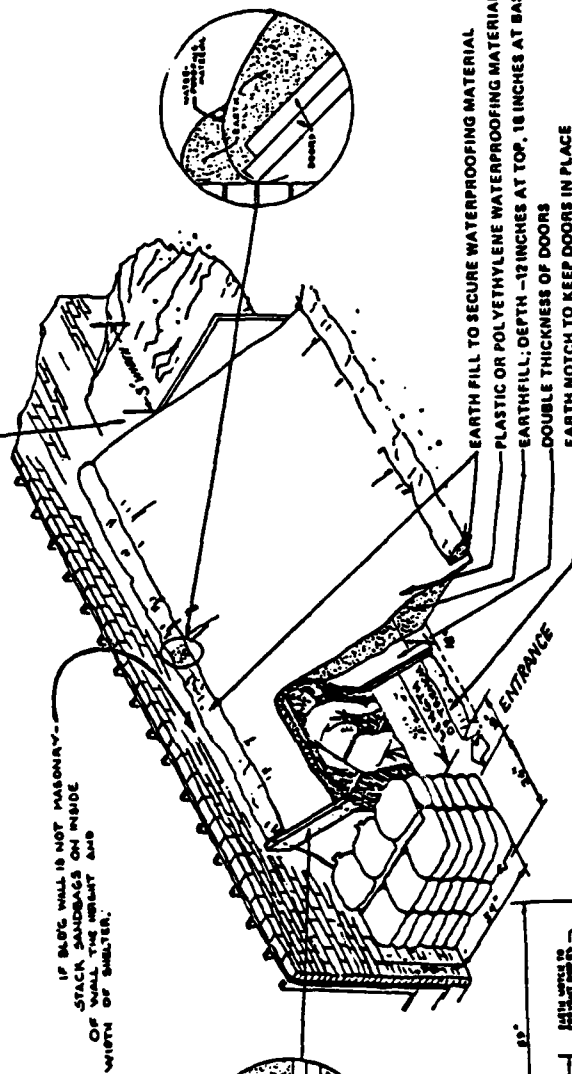
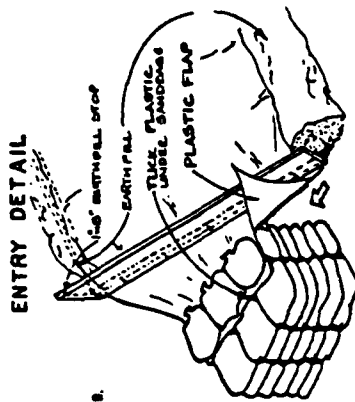
PLACE ONE END OF THE ROLLED UP WATERPROOFING MATERIAL UNDER THE TOP EDGE OF THE DOORS BEFORE EARTH FILL IS PLACED. BEGIN PLACEMENT OF EARTH FILL ON DOORS. COVER THE EARTH FILL WITH WATERPROOFING MATERIAL, SECURING IT WITH EARTH AT TOP AND BOTTOM TO PREVENT IT FROM BLOWING AWAY.

#### STEP 5

CONSTRUCT ENTRANCE - FILL "SANDBAG PILLOW" CASES WITH EARTH TAKEN FROM THE TRENCH AND STACK TO DIMENSIONS SHOWN AFTER DOORS ARE IN PLACE. PLASTIC OR POLYETHYLENE WATERPROOFING MATERIAL ENTRANCE COVER SHOULD BE IN PLACE BEFORE EARTH FILL IS PUT ON THE DOORS.

### TOOLS AND MATERIALS

1. TOOLS: PICK, SHOVEL, HAMMER, S&W, SCREWDRIVER, KNIFE, VARIOUS STICKS.
2. SANDBAGS PILLOWCASES OR PLASTIC GARBAGE BAGS - AT LEAST 30.
3. LUMBER: 1" X 8" PIECE 7' LONG (OR 20 MORE SANDBAGS) FOR EARTH-FILL STOP AT ENTRANCE EDGE OF DOORS.
4. ROPE OR CORD TO TIE SAND BAGS.
5. DOORS: TWO LAYERS FOR LENGTH OF SHELTER PLUS ONE FOR END CLOSURE. (EXAMPLE: 7 DOORS FOR 3 PERSON SHELTER).
6. NAILS: 8 penny (2 1/2" LONG), ABOUT 10 TO NAIL EARTH STOP TO DOOR EDGES AT ENTRANCE.
7. PLASTIC OR POLYETHYLENE WATERPROOFING MATERIAL TO COVER DOUBLE LAYER OF DOORS PLUS ENTRANCE.
8. WORK GLOVES FOR EACH WORKER.





## ABOVE-GROUND RIDGE-POLE

3 PERSON SHEET IS ILLUSTRATED -  
FOR EACH PERSON ABOVE 5, MAKE  
A RIDGE POLE 1 FT LONGER FOR 6 TO  
8 PERSONS, USE 1 COLUMN POSTS -  
18 TO 16 PERSONS, USE 4 COLUMNS

## SECTION THRU COMPLETED SHELF-ER

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## 391

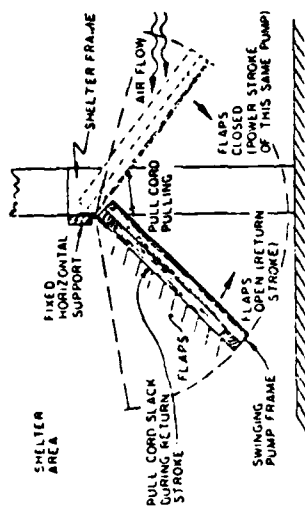
# EXPEDIENT FALL-OUT SHELTER

## AIR VENTILATION PUMP—EMERGENCY LAMP—BUCKET STOVE

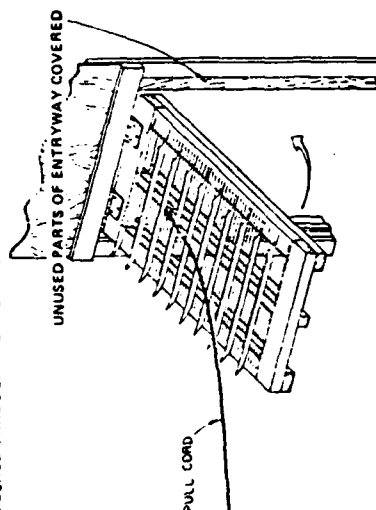
ALL EXPEDIENT SHELTERS ARE DESIGNED TO PROVIDE FOR SOME NATURAL VENTILATION IN VERY HOT WEATHER. ADDITIONAL VENTILATION MAY BE REQUIRED TO PROVIDE A LIVABLE TEMPERATURE. CONSTRUCTION OF AN AIR PUMP THAT CAN PROVIDE ADDITIONAL VENTILATION IS ILLUSTRATED BELOW.

### STUDY ALL INSTRUCTIONS BEFORE STARTING CONSTRUCTION

#### STEP 1 AIR PUMP



THE AIR PUMP OPERATES BY BEING SWUNG LIKE A PENDULUM. IT IS HINGED AT THE TOP OF ITS SWINGING FRAME. IT IS SWUNG BY PULLING AN ATTACHED CORD. THE FLAPS ARE FREE TO ALSO SWING AND WHEN THEY ARE IN THE CLOSED POSITION, AIR IS PUSHED THROUGH THE OPENING THAT THE PUMP IS ATTACHED TO.



TO OBTAIN MAXIMUM EFFICIENCY AND MOVE THE LARGEST AMOUNT OF AIR, THE UNUSED PORTIONS OF THE ENTRYWAY SHOULD BE COVERED WITH WOOD, PLASTIC, CLOTH, STIFF PAPER OR SIMILAR MATERIALS.

STEP 2 MATERIALS AND TOOLS NEEDED TO CONSTRUCT AN AIR PUMP  
(MATERIALS SIZED FOR A 36 INCH BY 29 INCH PUMP)  
LUMBER SIZES CAN BE ALTERED, DEPENDING ON AVAILABILITY.

A. LUMBER			
SIZE	QUANTITY	SIZE	QUANTITY
1" X 2" X 36"	2	1" X 2" X 32"	2
1" X 1" X 36"	1	1" X 1" X 32"	1
1" X 2" X 29"	2	1" X 4" X 36"	1

B. ONE PAIR ORDINARY DOOR OR CABINET BUTT HINGES, OR METAL STRAP HINGES, OR IMPROVISED HINGES MADE OF LEATHER, WOVEN STRAPS, CORDS OR FOUR HOOK & EYE SCREWS WHICH CAN BE JOINED TO FORM TWO HINGES.

C. 24 NAILS ABOUT 2" LONG, PLUS SCREWS FOR HINGES.

\*D. POLYETHYLENE FILM, 1/2 MILS THICK, OR PLASTIC DROP CLOTH, OR RAINCOAT-TYPE FABRIC, OR STRONG HEAVY PAPER — 10 RECTANGULAR SHAPED PIECES, 30" X 54".

\*E. 30' OF SMOOTH, STRAIGHT WIRE FOR USE AS FLAP PIVOT WIRES — (ABOUT AS THICK AS COAT-HANGER WIRE) OR CUT FROM 10 WIRE COAT HANGERS, OR 35' OF NYLON STRING (COAT HANGER WIRE THICKNESS).

\*F. 30 SMALL STAPLES, OR SMALL NAILS, OR 60 TACKS TO ATTACH FLAP PIVOT WIRES TO WOOD FRAME.

\*G. 30' OF 1/2" TO 1" WIDE PRESSURE SENSITIVE WATERPROOF TAPE THAT DOES NOT STRETCH, OR USE NEEDLE AND THREAD TO SEW HEM TUNNELS TO THE FLAPS.

\*H. FOR FLAP STOPS, 150 FT OF LIGHT STRING, STRONG THREAD, OR THIN SMOOTH WIRE. 90 TACKS OR SMALL NAILS TO ATTACH FLAP STOPS TO THE WOOD FRAME, OR FLAP STOPS CAN BE TIED TO THE FRAME.

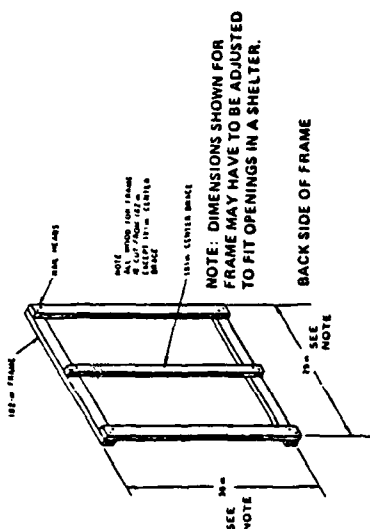
I. 10 FEET OF CORD FOR THE PULL CORD.

J. DESIRABLE TOOLS: HAMMER, SAW, WIRECUTTER, PLIERS, SCREWDRIVER, SMALL DRILL, SCISSORS, KNIFE, YARDSTICK, AND PENCIL.

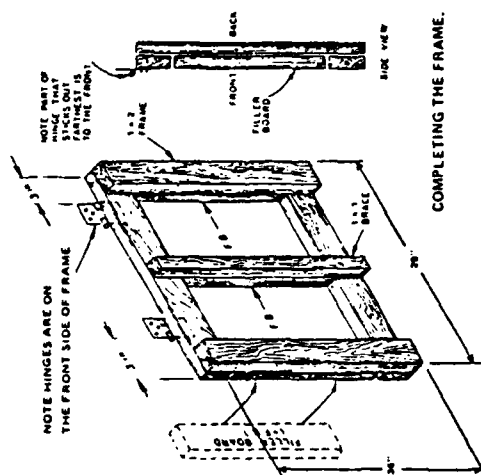
\* Items must be sized or adjusted to fit opening into which air pump is to be placed.

### STEP 3 HOW TO CONSTRUCT THE AIR PUMP

#### A. CUT LUMBER AND ASSEMBLE FRAME AS SHOWN

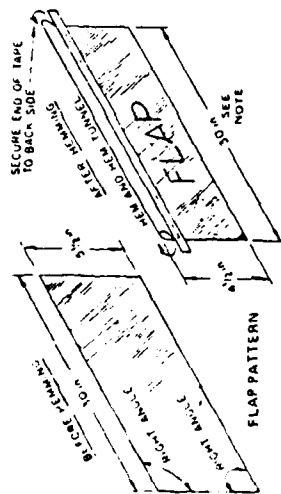


B. COMPLETE FRAME AND ATTACH HINGES. IF DRILL IS NOT AVAILABLE TO DRILL SCREW HOLES TO ATTACH HINGES, USE A NAIL TO MAKE THE HOLES.



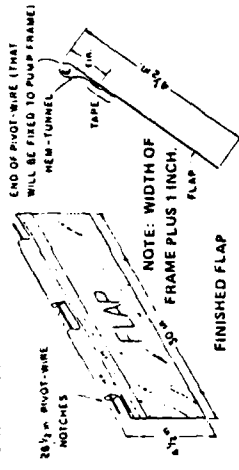
# HOW TO CONSTRUCT THE AIR PUMP (CONT'D)

- C CUT 10 RECTANGULAR STRIPS 20" LONG BY 5 1/2" WIDE FOR USE AS FLAPS. HEM FLAPS AS SHOWN. USE PRESSURE SENSITIVE TAPE OR SEW HEM SHUT TO FORM HEM TUNNEL.

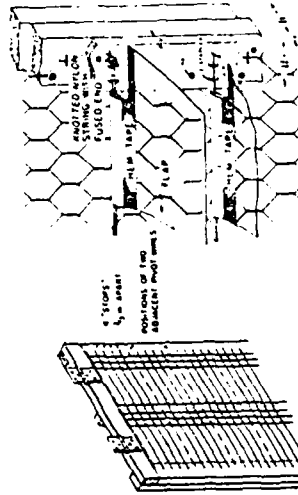


NOTE: WIDTH OF FRAME PLUS 1 INCH

- INSERT 10 PIECES OF STRAIGHT WIRE (PIVOT WIRES) INTO FLAP HEM AS SHOWN. FLAPS SHOULD SWING FREELY. STRING CAN BE USED IF WIRE NOT AVAILABLE (WIRE COAT-HANGER THICKNESS).



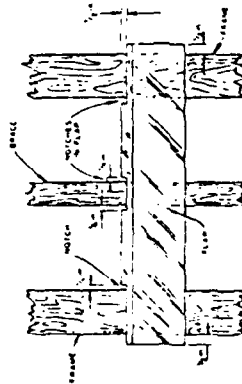
- E ATTACH FLAP STOPS (STRINGS OR WIRES) TO THE PUMP FRAME AT THE MARKED LOCATIONS. 4 FLAP STOPS ARE NEEDED BETWEEN ADJACENT PIVOT WIRES.



ATTACHING FLAP STOPS.

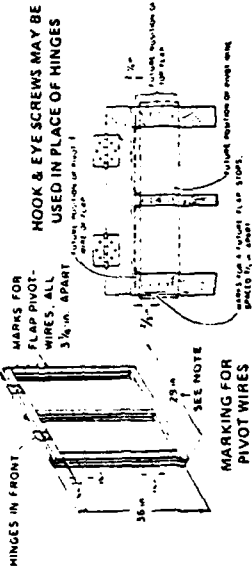
ALTERNATE METHOD - WIREMESH AS FLAP STOPS.

- AFTER HEM IS MADE, CUT NOTCHES IN FLAPS AS SHOWN. AVOID CUTTING TAPE THAT HOLDS HEM.



SIZE OF NOTCHES IN FLAPS

- D MARK PUMP FRAME FOR PIVOT WIRE AND FLAP STOP LOCATIONS.

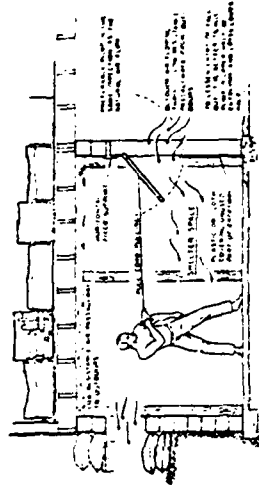


MARKING FOR FLAP STOPS.

NOTE: FRAME DIMENSIONS MAY HAVE TO BE ADJUSTED TO FIT OPENING IN SHELTER

- F STARTING FROM THE BOTTOM - STAPLE, NAIL, TACK OR TIE THE FLAP PIVOT WIRES WITH FLAPS IN THEIR MARKED POSITIONS. ATTACH HINGES TO HORIZONTAL SUPPORT BOARD. ATTACH PULLCORD TO CENTER BRACE.

STEP 4. TYPICAL INSTALLATION OF AIR PUMP



## Appendix C

## Earthquake Size

Intensity is an indication of an earthquake's apparent severity at a specified location, as determined by experienced observers. Through interviews with persons in the stricken area, damage surveys, and studies of earth movement, an earthquake's regional effects can be systematically described. For seismologists and emergency workers, intensity becomes an efficient shorthand for describing what an earthquake has done to a given area.

The Modified Mercalli Intensity Scale generally used in the United States grades observed effects into twelve classes ranging from I, felt only under especially favorable circumstances to XII, damage total. The older Rossi-Forel Intensity scale, or R. F., has ten categories of observed effects, and is still used in Europe. Still other intensity scales are in use in Japan and the USSR.

Rating earthquakes by intensity has the disadvantage of being always relative. In recent years, intensity ratings have been supplemented by an "objective" scale of earthquake magnitude.

Magnitude expresses the amount of energy released by an earthquake as determined by measuring the amplitudes produced on standardized recording instruments. The persistent misconception that the "Richter Scale" rates the size of earthquakes on a "scale of ten" is extremely misleading, and has tended to mask the clear distinction between magnitude and intensity.

Earthquake magnitudes are similar to stellar magnitudes in that they describe the subject in absolute, not relative, terms, and that they refer to a logarithmic, not an arithmetic, scale. An earthquake of magnitude 8, for example, represents seismograph amplitudes ten times larger than those of a magnitude 6 earthquake, and so on. There is no highest or lowest value, and it is possible here, as with temperature, to record negative values. The largest earthquakes of record were rated at magnitude 8.9; the smallest, about minus 3. Preliminary magnitude determinations may vary with the observatory, equipment, and methods of estimating--the Alaska earthquake of March 1964, for example, was described variously as magnitude 8.4, 8.5, 8.6 by different stations.

Magnitude also provides an indication of earthquake energy release, which intensity does not. In terms of ergs\*, a magnitude 1 earthquake releases about one billionth the energy of a magnitude 7 earthquake; a magnitude 5, about one thousandth that of a magnitude 7.

### Earthquake Safety Rules

An earthquake strikes your area and for a minute or two the "solid" earth moves like the deck of a ship. What you do during and immediately after the tremor may make life-and-death differences for you, your family, and your neighbors. These rules will help you survive.

#### During the shaking.

1. Don't panic. The motion is frightening but, unless it shakes something down on top of you, it is harmless. The earth does not yawn open, gulp down a neighborhood, and slam shut. Keep calm and ride it out.
2. If it catches you indoors, stay indoors. Take cover under a desk, table, bench, or in doorways, halls, and against inside walls. Stay away from glass.
3. Don't use candles, matches, or other open flames, either during or after the tremor. Douse all fires.
4. If the earthquake catches you outside, move away from buildings and utility wires. Once in the open, stay there until the shaking stops.
5. Don't run through or near buildings. The greatest danger from falling debris is just outside doorways and close to outer walls.
6. If you are in a moving car, stop as quickly as safety permits, but stay in the vehicle. A car is an excellent seismometer, and will jiggle fearsomely on its springs during the earthquake; but it is a good place to stay until the shaking stops.

#### After the shaking.

1. Check your utilities, but do not turn them on. Earth movement may have cracked water, gas, and electrical conduits.
2. If you smell gas, open windows and shut off the main valve. Then leave the building and report gas leakage to authorities. Don't reenter the house until a utility official says it is safe.
3. If water mains are damaged, shut off the supply at the main valve.
4. If electrical wiring is shorting out, close the switch at the main meter box.
5. Turn on your radio or television (if conditions permit) to get the latest emergency bulletins.
6. Stay off the telephone except to report an emergency.

7. Don't go sight-seeing.
8. Stay out of severely damaged buildings; aftershocks can shake them down.

### Family Earthquake Drill

Where will you go for protection when your house starts to shake--and you're in the living room or the bedroom or the kitchen, or the bathroom?

What if you're in one part of the home and your children are in another? During a violent earthquake, you're not going to have time or steady legs to reach them. Will they know what to do to protect themselves? Will you?

The degree of shaking you will experience in an earthquake depends upon many factors:

The magnitude of the earthquake--the amount of energy released.

The distance between you and the earthquake's epicenter.

The geology--the type of rock on which your home is built.

In a major earthquake, you may experience a shaking that starts out to be gentle and within a second or two grows violent and knocks you off your feet.

Or

You may be jarred first by a violent jolt--as though your house was hit by a truck. A second or two later you'll feel the shaking; and, as in the first example, you'll find it very difficult (if not impossible) to move from one room to another.

These examples should give you a clue that you and your family may have only one or two seconds to

get under a sturdy table

move away from windows that may shatter

move away from the fireplace and from where the chimney may fall

head for a doorway, but only if there is no door attached (a door could slam shut ON YOU).

Most of all, you shouldn't waste time thinking about where you'll be safe. Use the initial one or two seconds to REACT APPROPRIATELY AND AUTOMATICALLY.

How do you turn the tendency to panic into thoughtful action? By thinking before the earthquake occurs. By conditioning yourself and your family to react correctly and spontaneously when the first jolt or shaking is felt.

How? PRACTICE. Play a game now that will save you and your family from serious injury.

The EARTHQUAKE DRILL is a game because you are pretending "where will I go when the house starts to shake?"

The first step is to acquaint each family member with safe spots in each room of your home. Then reinforce this knowledge by physically placing yourselves in these locations. This is a very important step for your children. They must learn to react automatically in case you are not beside them at the critical time.

In the days that follow this initial exercise, hold surprise earthquake drills. Call out "EARTHQUAKE" from the living room or kitchen. Each family member should respond by moving to the nearest safe place.

Once a month let a child call a surprise earthquake and follow through with what you've learned. Test each other. Was David's choice the safest? Did Sally realize that the closet door could be sealed shut? Did the person in the kitchen remember to turn off the stove?

---

You should consider now what you may experience after a major earthquake. For example, when the shaking is over, you should be prepared for aftershocks. Most important, remind your family to stay close enough to touch and comfort each other. Assign each family member a chore to do to mend the household.

Talk about what happened and be sure to let your children know what they felt, how afraid and how brave they were. There will be time enough to forget. Nightmares usually go away when they're talked over with someone who understands.

#### EARTHQUAKE HAZARD HUNT

The Earthquake Hazard Hunt should begin at home, with all family members participating. Foresight, imagination, and common sense are all that are needed as you go from room to room and imagine what would happen when the earth and house start shaking.

Look at that floor-to-ceiling bookshelf: How many things are likely to fall? Maybe the whole works, if it is not fastened properly.

Which items are heavy enough to cause injury? During a moderate shake, objects may topple from shelves and fall in a vertical path. During a violent shake, however, heavy objects may be propelled to fall in a diagonal path.

What should you do? Secure the bookshelves to wall studs. Be sure that shelf brackets are fixed to shelves. Remove all heavy objects from shelves above head level of shortest family member.

Do you have hanging plants? How are they fastened? Could they swing free of their hooks? As a minimum precaution, transfer hanging plants from heavy clay pots to lighter plastic ones.

Where do you sit or sleep. Is there a heavy picture frame or mirror over your head?

What kind of latches are on the kitchen cabinets? Consider replacing magnetic "touch" latches with ones that will hold the cabinet door shut during an earthquake.

Remove glass bottles from medicine cabinet and from above or around bathtub. After a damaging earthquake, you may need to draw water into the tub. This would certainly be a futile gesture with a tub full of broken glass.

---

Now it's your turn to do some detective work. All family members should join in. Children are especially perceptive; they're likely to mention several hazards you may have missed.

Don't forget to check your garage. Where do you store weed killers and pesticides? Where do you keep flammable products?

Is your hot water heater secured for earthquake country? To do so is simple and inexpensive. Thin metal tape, known as "plumber's tape," can be used to fasten your hot water heater to the wood studs of the nearest wall. Don't rely on pipe lines to support hot water heaters or other gas heating units. These appliances must be strapped to a solid wall to restrict their movement in an earthquake. Even a moderate earthquake could cause sufficient movement to rupture the gas lines.

Check the outside of your home. What about your chimney? Where are those bricks likely to fall?

---

With your powers of perception finely tuned, extend this hazard hunt to your place of work. If you have little or no control of your work environment, at least check to determine if your company has an earthquake safety plan.

Children may have little to say about where they sit at school relative to hanging light fixtures or windows. However, they can share



their new awareness with their classmates; and you can determine if their school has a practical earthquake plan, if earthquake drills are held, and what the policy is if an earthquake should occur while school is in session.

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Abstract

Many emergencies can be prevented. Nearly all impacts resulting from emergencies can be effectively ameliorated by prior preparation and planning. This handbook provides citizens with the knowledge to plan and prepare for dealing with most emergencies. It likewise informs them of actions which governmental and private agencies are likely to take in emergencies, thus helping citizens to improve their chances of survival and minimize threats to themselves and their property. Procedures for assisting others, either individually or through volunteer work with agencies, is also given.

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Many emergencies can be prevented. Nearly all impacts resulting from emergencies can be effectively ameliorated by prior preparation and planning. This handbook provides citizens with the knowledge to plan and prepare for dealing with most emergencies. It likewise informs them of actions which governmental and private agencies are likely to take in emergencies, thus helping citizens to improve their chances of survival and minimize threats to themselves and their property. Procedures for assisting others, either individually or through volunteer work with agencies, is also given.

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